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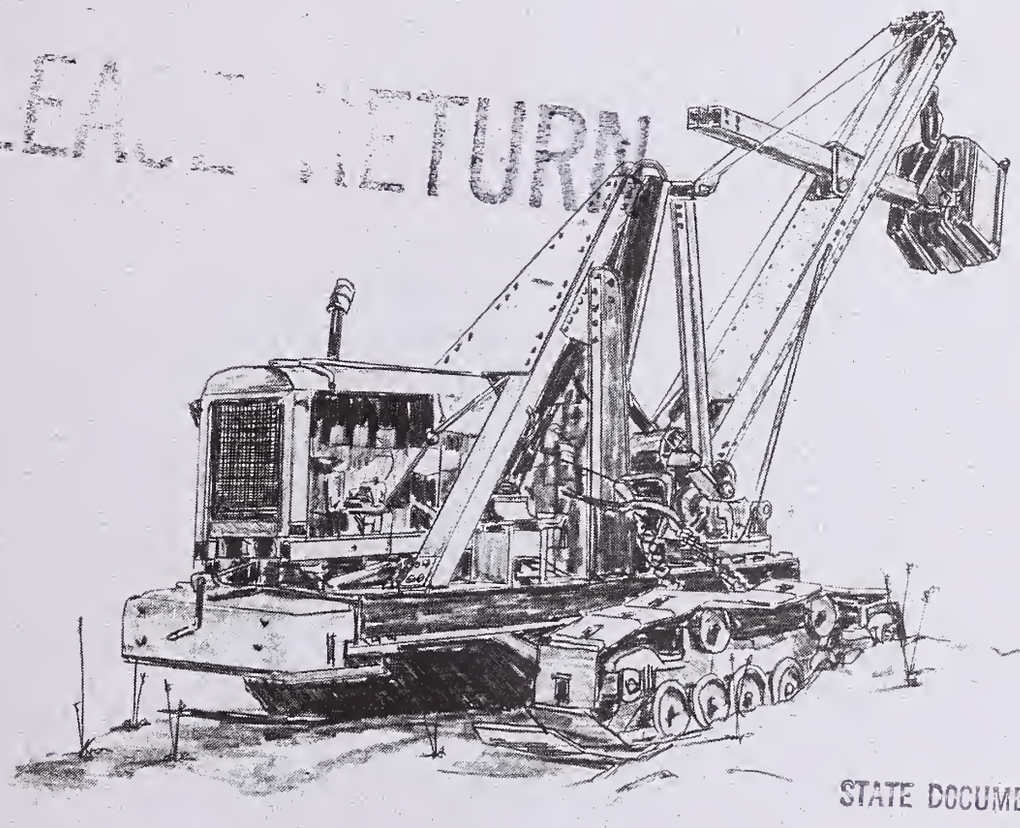
Montana. Hard Rock Bureau
Draft environmental impact statement for Pegasus Gold Corporation's.

DRAFT ENVIRONMENTAL IMPACT STATEMENT

FOR

PEGASUS GOLD CORPORATION'S DIAMOND HILL MINE PROJECT



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DRAFT ENVIRONMENTAL IMPACT STATEMENT

for

PEGASUS GOLD CORPORATION'S DIAMOND HILL MINE PROJECT

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PREPARED BY:

STATE OF MONTANA
DEPARTMENT OF ENVIRONMENTAL QUALITY
HARD ROCK BUREAU
HELENA, MONTANA

PURSUANT TO THE
MONTANA ENVIRONMENTAL POLICY ACT

(February 1996)

COVER SHEET

Type of Statement: Draft Environmental Impact Statement (EIS)

Proposed Action: Construction and operation of Pegasus Gold Corporation's (Pegasus) Diamond Hill Mine Project

Lead Agency: Montana Department of Environmental Quality

Abstract:

The draft EIS for Pegasus's Diamond Hill Mine Project describes the land, people and resources potentially affected by the proposed Diamond Hill gold and silver mine. The major state action would consist of the approval of the permit application in order for Pegasus to construct, operate and reclaim the proposed Diamond Hill Mine Project. The proposed project would consist of five primary components: (1) an underground mine with one portal and one vertical raise, (2) truck haulage of ore to an off-site custom mill and/or construction of an on-site mill, (3) a waste rock repository or a waste rock/tailings repository, (4)access roads, and (5) a stormwater reservoir and/or infiltration galleries. The potential impacts of three alternatives are analyzed in detail in this draft EIS: a no-action alternative, Pegasus' proposed action, and a mitigated project.


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PREFACE

An EIS is not usually read like a book, from chapter one to the end. The best way to go about reading an EIS depends on what your interests are. You may be more interested in impacts, while others might have more interest in the details of the proposed plan, or be more concerned about what opportunities were made available for the public to be involved in the environmental assessment process. Many readers probably just want to know what is being proposed and how it will effect them.

This document follows the format established in the Montana Environmental Policy Act regulations (ARM 26.2.47-655). The following paragraphs outline information contained in the chapters and appendices so that readers may find the parts of interest without having to read the entire document.

- **Summary:** contains a short, simple discussion to provide the reader and the decision makers with a sketch of the more important aspects of the EIS. The reader can obtain additional, more detailed information from the actual text of the EIS.

- **Chapter 1 - Purpose and Need for the Action:** describes the proposed action, project objectives and need, project history and background, the EIS process, agency roles and responsibilities, agency decisions to be made, public participation, the significant issues associated with the proposed action and issues that will not receive further consideration.

- **Chapter 2 - Description of Alternatives:** describes the development of alternatives. It identifies the pertinent components of the proposed action and alternatives, including the no-action alternative. Other alternatives that were considered but dismissed are identified along with rationale for not including them in the analysis. Reasonably foreseeable activities in the vicinity of the proposed project are identified. This chapter also provides a comparative analysis of the environmental impacts of the primary alternatives to provide a clear basis of choice among options for the decision maker and the public. The lead agency's preferred alternative is identified.

- **Chapter 3 - Affected Environment:** describes the present condition of the environment that would be affected by the proposed action and alternatives.

- **Chapter 4 - Environmental Consequences:** describes the probable direct and indirect impacts to the human environment that would result from developing the proposed action or alternatives, including cumulative impacts, short-term uses versus long-term productivity, unavoidable impacts, and irreversible or irretrievable impacts. Resources without significant impacts and/or issues are not discussed.

- **Chapter 5 - Consultation With Others:** identifies the agencies, companies, and organizations consulted as well as the cooperating agencies.

- **Chapter 6 - Preparers and Contributors:** identifies the people involved in the research, writing, and internal review of the draft EIS.

- **Chapter 7 - Distribution and Review of the EIS:** lists agencies, organizations and individuals who received a copy of the draft EIS.

- **Chapter 8 - Glossary:** describes the technical terms, abbreviations, and acronyms used in the draft EIS.

- **Chapter 9 - References Cited:** lists the references cited in the draft EIS.

- **Index:** contains cross-references and identifies the pages where key topics can be found.

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SUMMARY OF THE DIAMOND HILL MINE PROJECT EIS

INTRODUCTION

This summary is a condensation of the draft Environmental Impact Statement (draft EIS) for Pegasus Gold Corporation's Diamond Hill Mine Project. More detailed information is contained in the full text of the draft EIS. The draft EIS, if not attached, may be obtained from the following person:

Kathleen Johnson
Montana Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901
(406) 444-1760

A copy of the EIS can also be reviewed at the following locations:

Montana Department of Environmental Quality, Helena, MT;
Broadwater County Library, Townsend, MT;
Lewis and Clark County Library, Helena, MT;
Jefferson County Library, Boulder, MT, and
Montana State Library, Helena, MT

THE EIS AND PERMITTING PROCESS FOR THE DIAMOND HILL MINE PROJECT

The Diamond Hill Mine Project is a proposed underground gold and silver mine in Broadwater County, Montana, near Townsend, Montana (see **Figure S-1**). The project is proposed and would be operated by Pegasus Gold Corporation (Pegasus). Pegasus currently owns or controls the mineral rights within the proposed project boundary. The purpose of the proposed action is to develop these interests. The project would involve three phases. The first two involve transporting ore off-site for processing and developing associated mine waste disposal facilities. The third phase would include constructing an on-site mill for ore processing if deemed economical in the future as well as constructing a stormwater reservoir and expanding the mine waste facilities for tailings disposal. Plans include reclamation of all surface disturbances associated with the project.

Procedures governing the EIS analysis process in Montana are defined in administrative rules implementing the Montana Environmental Policy Act (MEPA). This draft EIS was written to meet the requirements of this statute and the administrative rules and regulations implemented by the

Department of Environmental Quality (DEQ). DEQ serves as lead agency for this EIS. The EIS was prepared in response to Pegasus' March 1995 application to construct, operate and reclaim the Diamond Hill Mine. DEQ and Pegasus jointly agreed to the preparation of an EIS instead of an Environmental Assessment (EA).

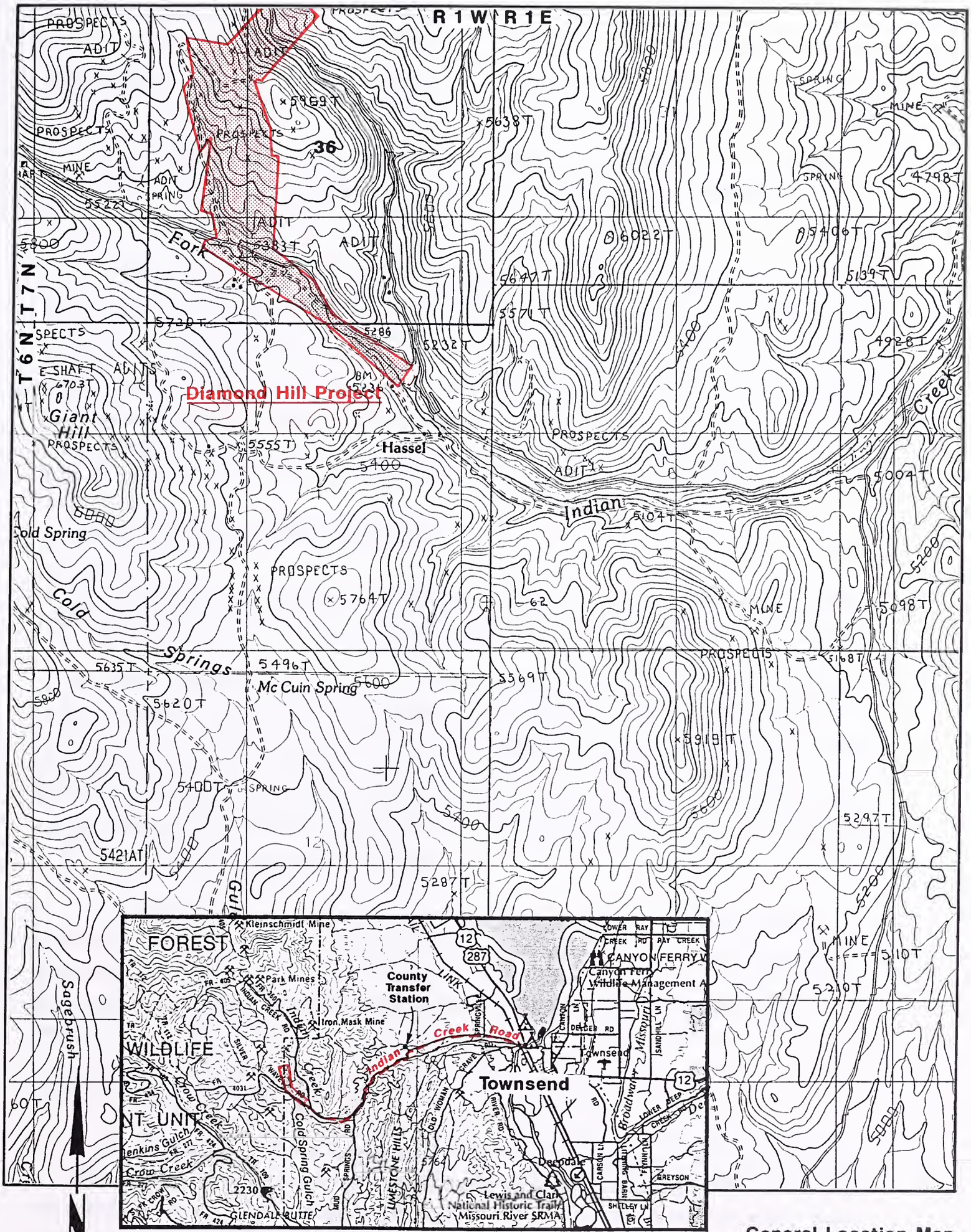
During the preparation of this draft EIS, the Montana Legislature created a new Department of Environmental Quality, integrating portions of the Department of State Lands (DSL) and the Department of Health and Environmental Sciences (DHES) into the new department. Hereinafter, whenever DSL and DHES are referred to, it should be noted that it pertains to activities conducted or documents prepared prior to July 1, 1995.

The scope of the draft EIS includes actions, alternatives, and analyses that will be considered by the decision maker in order to fulfill DEQ's regulatory responsibilities. Preparation of a draft EIS for the Diamond Hill Mine Project provides a coordinated and comprehensive analysis of potential environmental impacts. The decision to be made by the director of DEQ is to grant or deny the operating permit for Pegasus to operate the Diamond Hill Mine Project. The permitting decision will be based on the environmental effects and consequences relative to legal standards as documented in this EIS, along with other information presented during the agency decision-making process. In addition, this information will be used to determine the need for supplemental conditions to operate the project, if approved.

DEVELOPMENT OF ALTERNATIVES

Under MEPA regulations, the lead agency is required to consider the environmental effects of a proposed action and any reasonable alternatives to that action. Two alternatives that must be considered in the EIS are the proposed action -- construction, operation and reclamation of the Diamond Hill Mine Project -- and the no-action alternative, or denial of permits and approvals. Other alternatives are developed through public participation and identification of significant issues.

Public participation has been a key element in preparing this draft EIS. Opportunity for public involvement occurred in the beginning of the EIS process and was formally implemented when "scoping" was conducted on April 27, 1995 in Townsend. Scoping is a process designed to identify a broad list of environmental issues associated with the proposed action. The department determined the significant issues from those identified during the scoping period. The subsequent analyses presented in the EIS focus on identified significant issues.



Revised May 1995

General Location Map
Diamond Hill Mine Project
Broadwater County, Montana
FIGURE S-1

Based on the range of environmental issues identified by the public during scoping and analysis by the Department, two significant issues drove the development of alternatives and evaluation of impacts: county economics and traffic safety.

Several alternatives were evaluated by Pegasus and DEQ but were dismissed from detailed analysis in the draft EIS. These alternatives were either technically or economically infeasible, would result in greater environmental effects, were beyond the ability of DEQ to implement, or offered no advantages to alternatives considered in detail. The range of alternatives considered but dismissed by Pegasus included: alternate off-site or adjacent mill sites, metallurgical recovery systems, mining methods, waste rock and/or tailings disposal methods and locations, and water handling systems (see Pegasus Gold Corp. 1995a, Section 7.0). DEQ did not consider any of these alternatives further because they did not address either significant issue driving alternative development.

ALTERNATIVES DISCUSSED IN THE EIS

The first alternative discussed is the No-Action Alternative. Pegasus would not develop the Diamond Hill Mine Project but could continue with approved exploration and reclamation activities.

The proposed Diamond Hill Mine Project comprises a 122-acre mine permit area with a surface disturbance of up to 37.2 acres. Development of the proposed project would consist of underground mine workings; a waste rock or waste rock/tailings repository; stormwater capture and disposal systems; stockpiling, crushing, and hauling ore during the first two phases of mine development and operation to a mill at Montana Tunnels, Inc. near Jefferson City (or other suitable contract mill); and construction of a gravity flotation mill during Phase III (see **figures S-2, S-3, and S-4**). The mine would be reclaimed after closure.

The Mitigated Project incorporates mitigations proposed by DEQ to reduce or eliminate undesirable traffic safety concerns. These mitigations are in addition to or instead of mitigations proposed by Pegasus. This alternative would reduce negative impacts associated with the identified significant issue of traffic safety. No mitigations were proposed to reduce impacts to county economics.

THE AFFECTED ENVIRONMENT

The project area is situated in the foothills of the Elkhorn Mountains. The area is relatively dry and vegetation consists primarily of grasslands with scattered trees and sagebrush. Indian Creek and nearby streams have been extensively disturbed by historic mining since the mid-1800s. There are a few active placer mines and a limestone quarry within the area. There are numerous private

inholdings surrounded by lands managed by the Helena and Deerlodge National Forests, the Bureau of Land Management, and the State of Montana. These public lands are managed for a variety of uses including wildlife, recreation, and grazing. There has been some timber harvesting in the past, but current timber activities are primarily limited to Christmas trees, post and pole salvage, and firewood. The Elkhorns are used extensively for motorized recreation (off-road vehicles and recreational driving) and hunting due to close proximity to Helena, Townsend, and Butte.

CONSEQUENCES OF THE PROPOSED PROJECT AND ALTERNATIVES

All alternatives would result in impacts of varying magnitude, duration, and importance to resources with regards to the two issues discussed under Identification of Issues. The impacts, although not anticipated to be significant, would be greatest under both action alternatives.

Issue 1: County Economics

Over 6 years, both action alternatives would generate up to an estimated $1,164,134 ($956,706 to Broadwater County and $207,428 to Jefferson County) if all mining occurred under phases I and II. The estimated taxes would increase to $1,978,597 over a 6-year period to Broadwater County if all mining occurred under phases I and III. Although incoming mine workers and their families may increase demands on government services, especially the already crowded school system, the increased direct and indirect tax revenues generated by the mine, the mine employees and other indirect employment would partially offset the negative financial impacts. Pegasus has also proposed working out a tax payment plan with the county to further mitigate financial impacts.

Issue 2: Traffic Safety

The hauling of ore to Montana Tunnels or some other available facility would increase the average amount of traffic on Indian Creek Road by approximately 400 percent during Phase I and up to 700 percent during Phase II. Traffic during hunting season would be increased by over 400 percent from 22.7 vehicles to 122.7 vehicles per day under Phase II. The impact from increased traffic on Montana Highways 287/12 and Interstate 15 would be minimal.

However, this increase in traffic would increase the risk of traffic accidents along Indian Creek Road, especially in the canyon. Mitigations proposed by Pegasus would help reduce the risk. Mitigations suggested by DEQ would further reduce the risk but

would not eliminate it or reduce the number of vehicles that would potentially be using the road system. Implementation of the mitigations would depend upon agreement by the county, BLM, and some private landowners or lessees. The degree of risk reduction would depend on which mitigations were implemented and if and when each phase would be implemented.

THE AGENCY'S PREFERRED ALTERNATIVE

The agency-preferred alternative is the mitigated project. This alternative would have the greater opportunity to improve traffic safety along Indian Creek Road. However, the development of these mitigations depends upon cooperation and agreement between Pegasus, BLM, Broadwater County and possibly Continental Lime. DEQ prefers the traffic safety mitigation which involves some improvements to Indian Creek Road in conjunction with ASARCO's proposed transportation plans. This alternative would result in the expansion of the existing exploration decline and waste rock dump, construction of an addition infiltration gallery, the hauling of ore to Montana Tunnels or another suitable milling facility, and when the mine's economics permit, the development of a mill, stormwater reservoir, and waste rock/tailings repository.

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West Fork Indian Creek

Alluvial Borrow Area

County Road

Fence

F Tunnel

LAD Area

E Tunnel

Soil Stockpile Area

Trailer

Office

Bulk Sample Aree

Diversion Ditch

Lime Rock Stockpile

Waste Rock Repository

Settling Ponds

Pipeline

Seepage Collection Pond

Property Boundary

Existing Road

Buried Water Line

Water Supply Well

Limestone Infiltration Gallery

Fence

Fuel Storage

Trailer

Marquis Portal

Water Storage

Raise

D Tunnel

Property Boundary

400 Feet

N

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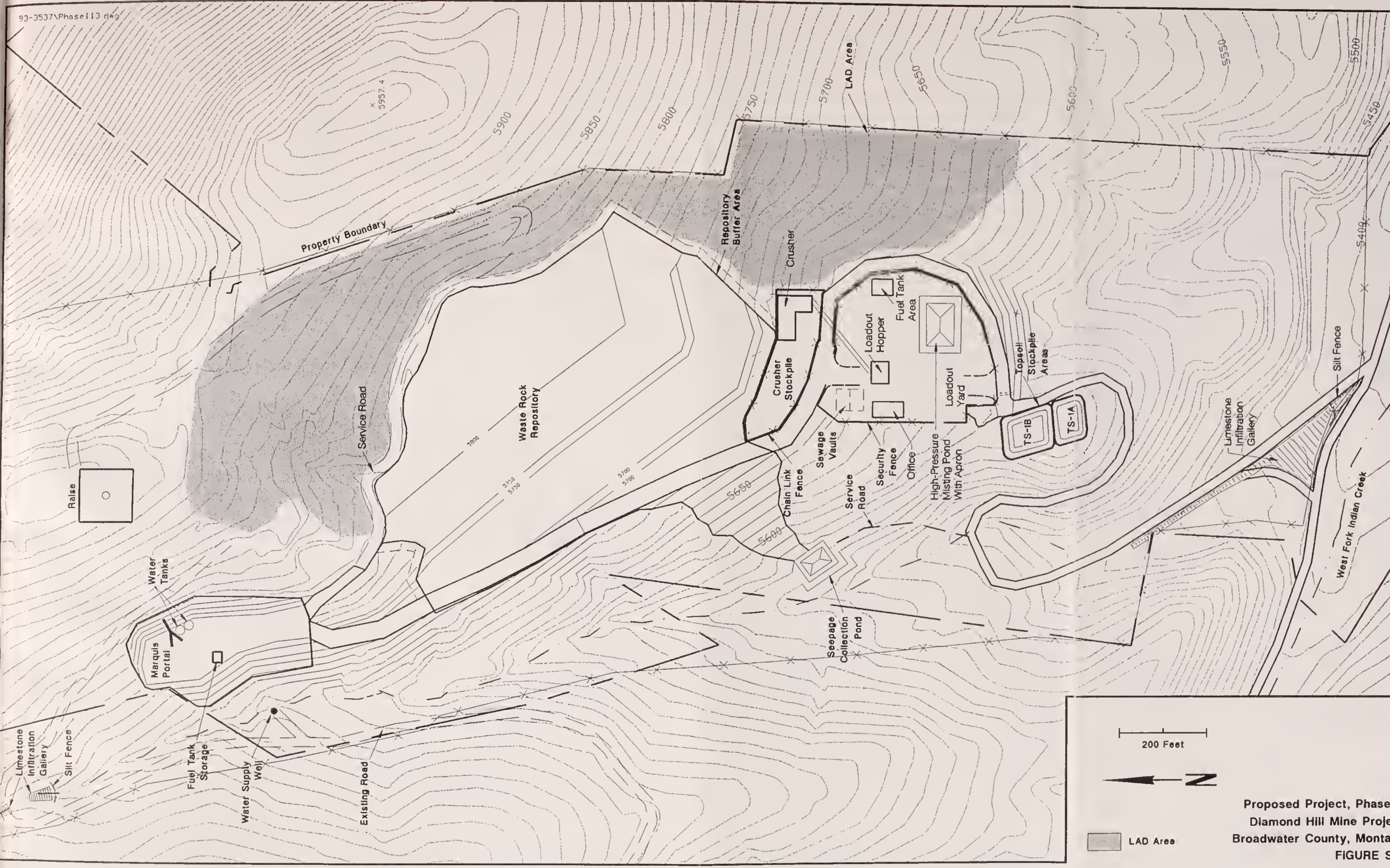
Proposed Project, Phase I
Diamond Hill Mine Project
Broadwater County, Montana
FIGURE S-2



Proposed Project, Phase II
Diamond Hill Mine Project
Broadwater County, Montana
FIGURE S-3

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Revised May 1995

Proposed Project, Phase III
Diamond Hill Mine Project
Broadwater County, Montana
FIGURE S-4

CHAPTER 1 - PURPOSE OF AND NEED FOR THE DIAMOND HILL PROJECT

This draft Environmental Impact Statement (EIS) discloses the direct, indirect and cumulative effects of a proposed gold and silver mining project and alternatives. This chapter describes the purpose and need for the proposed action; the EIS process; public participation; agency roles, responsibilities and decisions; and the identification of issues pertaining to the Diamond Hill Mine Project.

PROPOSED ACTION

Pegasus Gold Corporation (Pegasus) proposes to develop, operate, and reclaim an underground gold and silver mine and gravity flotation mill facility at the Diamond Hill project area in three phases (Pegasus Gold Corp 1995a). This project is in Broadwater County, on private land and approximately 8 miles northwest of Townsend, Montana (Section 36, T7N, R1W and Section 1, T6N, R1W) (See **Figure 1-1**).

The project could disturb up to 37.2 acres over a mine life of 10 years. Approximately 365,000 tons of ore per year would be produced for 6 years. Waste rock production would total 730,000 tons over the life of the mine. The existing 12 x 14-foot spiral decline and waste rock dump developed during exploration would continue to be used.

Trucks would deliver ore 24 hours a day to the mill at Montana Tunnels in Jefferson City or to some other suitable contract mill during the phases I and II. The Phase III on-site mill, if constructed, would operate 24 hours a day.

Up to 69 employees would be hired during 6 years of active mine production. There would be 2 underground shifts per day. The mine likely would draw employees from a 60-mile radius that would include Butte, Whitehall, Boulder, Helena, and Townsend.

PROJECT PURPOSE AND OBJECTIVES

Pegasus Gold Corporation

Pegasus proposes to construct, operate, and reclaim the proposed mine to produce gold and silver from their Diamond Hill reserves in an environmentally sound manner. The sale of gold and silver concentrate and dore' would produce a profit for the company and economic support for the county and state, as well as local and regional employment.

Department of Environmental Quality

The operating permit application for this project was received February 2, 1995, by the Hard Rock Bureau (HRB) former Department of State Lands (now the Department of Environmental Quality (DEQ)), pursuant to the Metal Mine Reclamation Act (MMRA). DEQ must review the proposed project and determine if it would comply with all applicable environmental regulations before a permit can be issued. This draft EIS has several purposes:

1. It serves to ensure that the director considers the natural and social sciences in operating permit decision-making;

2. It assists in the evaluation of reasonable alternatives and the development of conditions, mitigations, stipulations, or modifications to be made a part of the approved action;

3. It ensures the fullest appropriate opportunity for public review and comment on proposed actions, including alternatives and planned mitigations, and

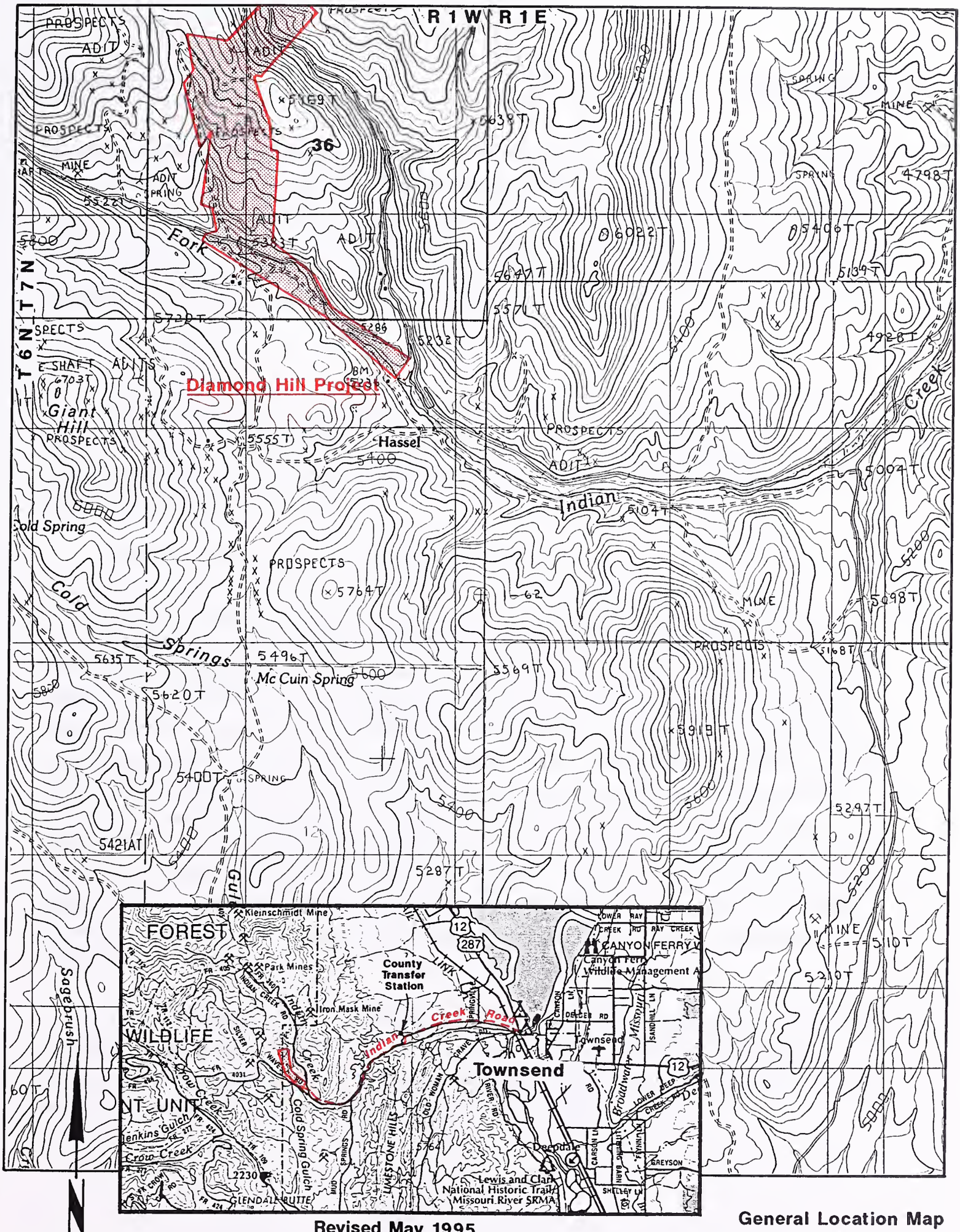
4. It examines and documents the effects of the proposed action and alternatives on the quality of the human environment, provides the basis for public review and comment, and assists the director in making an informed decision with regard to regulatory compliance should the Diamond Hill Mine Project be developed.

PROJECT NEED

Society uses gold for jewelry, eyeglasses, investments, monetary system standards, medicines, electronics and other industrial uses. The development of this project would help supply gold for these and other needs thereby decreasing the need to import foreign precious metals.

PROJECT HISTORY AND BACKGROUND

The Indian Creek or Hassel Mining District has been active since the late 1800s. Disturbances from both placer and hard rock mines are apparent throughout the area. Pegasus initiated exploration in 1988. Exploration activities permitted under Exploration License #00237 included the construction of drill pad sites and temporary exploration roads. Permitted exploration activities were expanded to include the construction of an underground decline with underground drilling. Characterization of waste which contained potentially acid-producing sulfides resulted in the development of a program to amend waste rock with lime to protect water quality. The expanded



Revised May 1995

General Location Map
Diamond Hill Mine Project
Broadwater County, Montana
FIGURE 1-1

exploration activities included a 300,000-ton lime-amended waste rock dump or repository, 1,410 feet of exploration road disturbance, a widened access road for waste rock haulage, an explosive materials storage area, a 10,000 ton bulk sample and storage site, a vertical raise for ventilation and emergency access, a runoff collection pond for sediment control, and reclamation which includes removal of facilities, capping the waste rock dump, and revegetating disturbed sites. In addition Pegasus has voluntarily reclaimed 3,090 feet of historic road disturbances and some historic tailings.

Land Status

Mining and ore processing at the Diamond Hill Project would take place entirely on lands owned and/or controlled by Pegasus Gold Corporation. Pegasus owns or controls the mineral estate for the patented claims. The permit boundary and areas proposed for disturbance would not extend beyond the patented claim boundary.

Associated Permit Approvals and Environmental Documents

One exploration license (#00237) approved May 13, 1988, (DSL 1988) and numerous subsequent amendment requests, amendment approvals, and Environmental Assessments (EA) pertain to Pegasus' exploration activities in the Diamond Hill area (they are available for review at DEQ-HRB). The exploration permit and all amendments require reclamation of exploration drill sites, roads, and other associated surface disturbances. Two amendments pertaining to the development of the exploration decline (Pegasus Gold Corp. 1993, 1994a, 1994b, 1994e, 1994f, and 1994g) involved more complex exploration activities and closely relate to the proposed Diamond Hill Mine Project. The EAs for these two amendments (DSL 1994a and 1994b) identified minor short-term visual impacts prior to reclamation and minor positive impact on local and state revenues. There would be a slight change in topography due to the waste rock repository. Alluvial material from a placer dredge pile in Indian Creek would be used as supplemental soil material due to insufficient or poor quality on-site soil for reclamation. Pegasus also will reclaim pre-existing historic roads and old mine tailings concurrently with their proposed exploration and reclamation activities.

Pegasus submitted a revision for Montana Tunnels Operating Permit #00113 for the deposition of tailings resulting from milling Diamond Hill ore at the Montana Tunnels mill. Although the revision (#95001) was determined to be complete, no decision will be made by DEQ on this revision until a decision has been rendered on the Diamond Hill Project (DEQ 1995).

THE EIS PROCESS

DEQ adheres to Montana Environmental Policy Act (MEPA) regulations (ARM 26.628 to 663). Applicable statutes require protection of air and water quality, as well as successful interim and final reclamation of disturbed areas, and compliance with other applicable federal and state laws and regulations.

An environmental assessment (EA) of this project could have been prepared, but if the EA had identified any significant impacts an EIS would have been required. DEQ and Pegasus jointly agreed that an EIS would be prepared for this project. This EIS presents the department's analysis of environmental impacts under MEPA regulations and guidelines. The department will use the analysis to make final permitting decisions concerning the operating permit application.

Procedures governing the EIS process in Montana are defined in administrative rules implementing MEPA. This law requires that if any action taken by the State of Montana might "significantly affect the quality of the human environment," an EIS must be prepared. In addition, other reasonable alternatives to the proposed project and a preferred alternative must be identified. This draft EIS was written to meet the requirements of these statutes and the administrative rules and regulations implementing these laws.

The EIS process involves several steps that are summarized as follows:

1. The public is afforded the opportunity to identify issues and concerns by participating in a public scoping meeting and by submitting written comments. Issues and comments are then addressed in the draft EIS.

2. The proposed action and any reasonable alternatives are summarized in the draft and final EISs.

3. Environmental resources that may be significantly affected by the proposed action or alternatives are described in the draft and final EISs.

4. Analyses of the impacts of the proposed action and alternatives are conducted and the results are presented in the draft EIS.

5. A public review and comment period, including a public meeting, occurs after publication of the draft EIS. Substantive comments are addressed in the final EIS.

6. The final EIS is published and used by the department to make a decision on the proposed action or alternatives.

7. A Record of Decision (ROD) is prepared by DEQ describing the decision, stating how the decision was made, and identifying required mitigation and monitoring measures and stipulations if an action alternative was selected.

AGENCY ROLES AND RESPONSIBILITIES

DEQ is the lead agency designated for this project. In addition to the hard rock mining permit approval by DEQ, various other permits, licenses, or approvals from DEQ and other agencies also would be necessary (**see Table 1-1**). The roles and responsibilities of the agencies with environmental permitting and regulatory responsibilities are discussed in the following sections.

Table 1-1. Primary Permits, Licenses, and Plans Required for the Diamond Hill Mine Project.

Permit, License or Plan	Purpose
State and Local Agencies	
Department of Environmental Quality	
State Operating Permit (Metal Mine Reclamation Act)	To allow mining development activity. Proposed activity must comply with state and federal environmental standards and criteria. Approval includes stipulations for final design of facilities, and monitoring plans.
Montana Pollution Discharge Elimination System Permit (Water Quality Act)	To establish effluent limits, treatment standards, and other requirements for point source discharges to state water.
Hazardous Waste Registration	To ensure safe transport of hazardous materials to and from the site.
Department and Board of Natural Resources and Conservation	
Water Rights Permit (Montana Water Use Act)	To allow beneficial use of state waters obtained through any surface water diversion over 35 gpm or through groundwater withdrawal exceeding 100 gpm.
Broadwater County Weed District	
Weed Management Plan	To minimize invasion of noxious weeds.

Department of Environmental Quality (DEQ)

DEQ administers the Montana Metal Mine Reclamation Act (MMRA) (Title 82, Chapter 4, Part 3, MCA), under which Pegasus has applied for a mine operating permit (Pegasus Gold Corp. 1995a). The purpose of this law is to prevent land and surface water degradation by requiring lands disturbed by mining (whether they be federal, state, or private) to be stabilized and reclaimed. The Metal Mine Reclamation Act requires an approved operating permit for all mining activities on non-Indian lands that disturb more than 5 acres or mine more than 36,500 tons of ore annually. The act and its regulations (ARM 26.4.101 et seq.) set forth the steps to be taken in the issuance of an operating permit for, and the reclamation of, the applicant's proposed mine project.

The director of DEQ must decide whether to approve the application as proposed, approve with modifications/mitigations, or deny the permit. The director may make a decision on Pegasus' permit application no sooner than 15 days following publication of the final EIS. Pegasus might have to modify its permit application to conform to the department's ROD.

Before an operating permit may be issued, a reclamation performance bond calculated by DEQ must be posted with DEQ. DEQ is authorized to bond mining operations under the MMRA (82-4-338, MCA). The bond amount must be sufficient for the state to complete reclamation in case of default by Pegasus. DEQ reclamation bonds include the cost of returning the site to comparable stability and utility.

Bonds are calculated once an alternative has been approved. The calculation then would be on file and available for public review. The amount of bond for reclamation is site specific and based on the alternative to be permitted. Calculations are based on the costs of regrading roads, parking lots, mine waste disposal areas, embankments, diversion channels, ponds, and impoundments, and replacing soil and vegetation on all disturbed areas. Costs for reclamation depend on the volume of material required site grading, the distance the material must be moved, and volumes of and distances to move soil for proper placement. In addition, if any capping materials or other special handling or treatment are required as a part of the reclamation plan, those volumes and distances hauled are part of the calculation. Bond calculations also include the costs of removal of buildings and other structures, portal plugging, revegetation, fertilization, temporary irrigation, and restriction of access to the site. Bonding includes implementation of monitoring for at least 5 years after the mine closes and contingency costs for reasonably foreseeable accidents. The calculations also include 10 to 20 percent for overhead costs. The bond must be submitted by the applicant prior to permit issuance.

Major changes in the operating or reclamation plans would require prior approval by DEQ and additional bonding. DEQ would routinely conduct inspections of the Diamond Hill Mine Project to ensure compliance with approved plans. Monitoring data collected by Pegasus would be evaluated, and if necessary, additional compliance activities would be implemented. DEQ would issue notices of violation and could level civil penalties of up to $5,000 per day of violation to enforce its regulations (82-4-361, MCA) if necessary.

DEQ administers the Clean Air Act of Montana (Title 75, Chapter 2, MCA). Any proposed project with potential to emit more than 25 tons per year of any pollutant must obtain an air quality permit before construction. The applicant must apply Best Available Control Technology (BACT) to each emission source. The applicant must also demonstrate that the project would not violate Montana or Federal Ambient Air Quality Standards. Pegasus has applied for an Air Quality Permit (Pegasus Gold Corp. 1995c).

DEQ is responsible for administration of the Montana Water Quality Act (Title 75, Chapter 4, MCA), providing for the classification of and standards for surface and groundwaters and the administration of permit programs to control the discharge of pollutants into state waters. Enforcement actions may include civil penalties of up to $25,000 per day of violation (75-5-631 MCA). Pegasus would be required to obtain a water quality permit if the discharge of water through the infiltration galleries reached surface waters.

DEQ is responsible for reviewing the mine construction and operation plans to ensure implementation complies with solid and hazardous waste laws and regulations. Current waste disposal regulations (16.14.503 and 504 ARM) require Group II Waste to be deposited in a Class I or II site. Group II wastes are inert solids and decomposable waste but not hazardous wastes. Group III wastes are only inert solids. The waste rock or waste rock tailings repository to be used for waste disposal at Diamond Hill would compare to a Class III site. The Department has determined that iron and steel wastes and treated timbers from the mine and mill could also be deposited in that site. The site would be situated where the potential for water pollution is minimized. Maximum penalties for hazardous waste violations are $10,000 per violation per day (75-10-417 MCA). Maximum penalties for solid waste violations are $1,000 per violation per day (75-10-214, 228, and 233 MCA).

State Historic Preservation Office (SHPO)

The SHPO is responsible for cooperating with and advising DEQ when potentially valuable historical, archaeological, or other cultural resources are located within a project area (Montana Antiquities Act Sections 22-3-401 through 22-3-442 MCA, and the National Historic Preservation Act (P.L. 89-665 as amended and re-authorized E.O. 11593)). Advice given DEQ may include comments

on an applicant's plan for impact mitigation of sites eligible for nomination to the National Register of Historic Places. This office also reviews the EA or EIS to ensure compliance with cultural regulations. The SHPO has identified sites within and surrounding the Diamond Hill area that could qualify for nomination (SHPO 1995). However, since there are no federal lands, monies or agencies involved in this project, it is not subject to compliance with Section 106 of the National Historic Preservation Act. An antiquities permit would not be required since the proposed project would be developed entirely on private land and would not disturb major eligible sites such as the stamp mill.

Department of Natural Resources and Conservation (DNRC)

DNRC administers one statute, the Montana Water Use Act (Title 85, Chapter 2, MCA (MWUA)), that might be applicable to this proposed mining development. A water rights permit is required by the MWUA for any surface water diversion or groundwater withdrawal exceeding 35 or 100 gallons per minute (gpm) respectively. This permit may not be required because Pegasus does not anticipate any water diversions or withdrawals of those magnitudes.

Broadwater County Weed District

The weed board administers the County Noxious Weed Control Act (7-22-2101 through 2153, MCA) for any land-disturbing activities within their jurisdiction. Pegasus would be required to submit a weed management plan to the Broadwater County Weed Board for review and approval.

AGENCY DECISIONS

The DEQ director will review the alternatives and weigh the opportunities, tradeoffs, and positive and negative impacts, and come to a decision. The ROD outlines the major points of the decision and the rationale used to reach the decision. The activities outlined in the decision document are then approved to be implemented on the ground. Decisions made pursuant to the MMRA can be challenged in district court for a period of 90 days after a permit is issued.

The DEQ director may deny a permit only when it can be demonstrated that air and water statutes cannot be complied with and/or the reclamation plan as proposed is not feasible (82-4-351, MCA). A permit may also be denied if a person, or any firm or business association of which that person was a principal or controlling member, has a bond forfeited (82-4-360, MCA) or for failure to reclaim an operation (82-4-341(6), MCA). (Pegasus has not forfeited any bonds under the MMRA and has not failed in its reclamation obligations.)

PUBLIC PARTICIPATION

Public participation begins as soon as a company submits an application for an operating permit. Public notice of receipt of the application was in the Helena Independent Record (February 9, 16, 23, 1995) and the Townsend Star (February 8, 15, 22, 1995). In addition to public review and comment on the application, DEQ reviewed the proposal for "completeness" to ensure adequate information was contained in the proposal to complete the environmental analysis. The application was determined to be complete on January 4, 1996.

Public participation is the key element of any EIS. The first formal opportunity for public involvement occurs in the beginning of the EIS process when "scoping" is conducted. The purpose of scoping is to compile a broad list of environmental issues related to the proposed action, and to rank these issues in order of significance. The subsequent analyses conducted in the EIS process focus on the identified significant issues. The scope of this EIS was established by this process.

A public meeting was held in Townsend on April 27, 1995, to record concerns of people interested in the Diamond Hill Mine Project. A number of written comments were also received during this process. These were compiled with issues and concerns expressed at the public meeting.

ISSUE IDENTIFICATION

The department identified the significant issues that would be used to define and evaluate the alternatives from written comments and public and agency scoping development. Two issues, defined as indicators of potentially significant effects, emerged from the scoping process. The effects have the potential to be adverse or beneficial, to be severe or longlasting, to affect a large area, or to occur frequently when a resource's quantity, quality, fragility or uniqueness are considered. Each issue is described below; the description does not represent a conclusion about the effects of the proposed project. The means of criteria by which changes would be estimated are also described.

Issue 1: County Economics - *Would the development or disapproval of the mine affect revenues for Broadwater County?*

The continued growth in the Townsend area has placed increasing demands on county, city and school district services. This growth has not kept pace with government ability to provide those services.

The means of estimating changes in county economics include: rating the number of jobs created by the proposed action and comparing the rating to other county employers and estimating the

additional projected revenue available to government units from taxes paid by the project, mine employees, and new project-related indirect employees.

Issue 2: Traffic Safety - *Would the additional mine-related traffic cause dangerous conditions in the canyon and upper portions of Indian Creek Road and Montana Highways 287/12?*

The proposed access route through Indian Creek Canyon is very narrow and twisting; the upper portion of the road is narrow with a steep drop to the creek below. Traffic hazards already exist and create problems during high-use recreational seasons and during emergency responses. Montana Highway 287/12 has fairly heavy use and is a major truck route to and from Helena and Great Falls.

The means of estimating changes in traffic safety are: standard measures of the amount of vehicle traffic or accident risks such as the number of accidents per number of vehicles that use Indian Creek (or similar roads where traffic data are available) and Montana Highway 287/12.

Issues That Will Not Receive Further Consideration

Some potential issues were initially considered by the DEQ but were dismissed because there were no public concerns, no impacts, or only minimal, short-term impacts. These issues are briefly described below, as well as the reason for their dismissal.

Although issues related to geology and hydrology have been dismissed, these resources and the potential impacts to them are described in more detail in chapters 3 and 4. This will provide readers with more information regarding the sensitive areas of water quality and surface subsidence.

Acid Rock Drainage/Contaminant Migration Potential: *Are there alternative designs or actions which would further reduce the potential for acid rock drainage (ARD) or contaminant migration at a neutral pH?* The ore and waste rock at the Diamond Hill mine site are sulfitic in nature. Exposure of sulfitic rock to air and water can produce acid with elevated metal concentrations (Gene Muller in Pegasus Gold Corp. 1995a). The proposed mine facilities are designed to reduce the possibility of runon, waste rock and water discharges. Acid formation and contaminant migration outside of the underground workings would be mitigated by isolating reactive and by blending amendments, such as limestone, with waste rock in the waste rock or waste rock/tailings repository. This issue was not considered to be significant based on the site's dry climate, good rock quality and deep static water table.

Air Quality: *Would project construction and operation increase the ambient particulate and gaseous concentrations in the area, which includes the Elkhorn Cooperative Management Area (ECMA)?* There would be a relatively small, localized increase in air pollutant levels in the immediate mine area, but they should remain well below state and federal ambient air quality standards. The air quality permit application for this project is being reviewed and the preliminary determination and analysis will be available for review from the department.

Bighorn Sheep and Other Wildlife: *Would mining and construction activities adversely affect reintroduced bighorn sheep? Would the proposed project adversely affect other wildlife species in the area such as elk?* In September 1995, the Montana Department of Fish, Wildlife and Parks issued a Record of Decision approving the reintroduction of Bighorn Sheep to the Elkhorn Mountains, specifically to the Indian Creek and Crow Creek drainages. According to the EA for that project, "The presence of bighorns on the ECMA are not predicted to solely limit activities presently occurring on the ECMA...Bighorn sheep are probably less sensitive to activities such as mining than other big game species occurring in the area....Other bighorn herds closely associated with mining operations, such as the Melrose population, have co-existed in the absence of much conflict." However, the bighorn sheep herd near the Stillwater Mine at Nye, Montana, has been impacted by that mine's activities. Potential factors at the Stillwater mine include: critical winter range, small herd size, moderately large mine operations (140 acres disturbed; 364 employees and 18-20 years of mine operations), and increased traffic in the area (DSL, DHES, and U.S. Forest Service 1992). The small amount of disturbance proposed for the Diamond Hill Mine Project would limit impacts to bighorn sheep in the Elkhorns.

The project would directly disturb less than 40 acres. The environmental baseline studies for wildlife did not identify any threatened or endangered species in the area to be impacted by the mine. No critical wildlife habitat use areas such as winter ranges or linkage corridors were identified in the area. Traffic from the 24-hour milling operation or from the increased traffic resulting from hauling the ore to an off-site mill would increase the potential for wildlife deaths due to collisions with vehicles. The traffic speed and mitigation measures proposed by the mining company would result in non-significant impacts to wildlife resources. Forage production would be returned to disturbed acres by reclamation after mining ceases. Wildlife should return to pre-mine use patterns in the area after traffic and noise generated by the operation cease.

Cultural Resources: *Would project construction affect historically important attributes in the area?* The project site is located in the Diamond Hill historic district. Many of the surface features of the district such as tailings piles, pits, and adits have already been disturbed by past mining and exploration activities, and Pegasus has reclaimed some sites during its approved exploration activities.

DEQ has determined that because the major eligible historic structures within the district, such as the stamp mill, will be avoided, there will be no significant affect on the historic integrity of the district.

Hazardous Materials: *Would the proposed mining and milling operations use hazardous materials? Are spills possible during transportation, handling, and/or storage of these materials? How would such spills be contained to eliminate potential adverse effects to wildlife and human health and to soil and water?* Pegasus does not propose to use cyanide during its milling operation. However, there are some chemicals proposed for use in the mill that are subject to regulation due to their quantity, concentration, or toxicity. Vendors hauling bulk chemical shipments would be escorted by pilot cars in radio contact with the mine and Pegasus' Townsend office. In the event of a spill enroute, the pilot car would immediately notify both offices and a spill response plan would be implemented in coordination with the Broadwater County Sheriff and the County Disaster and Emergency Relief Coordinator.

Noise: Would mine construction and operation increase the noise level in the Indian Creek drainage? How would such noise affect recreationists, residents, and wildlife? Noise from blasting is not a major concern with an underground mining operation. Noise generated by similar equipment used in mining and milling operations near Nye and Jardine, Montana, have not created problems for wildlife, recreationists or employees. The issue of noise was not raised as a concern by the public in scoping comments.

The agencies do not expect the noise generated by the proposed operations to present more than a minor nuisance to recreationists and wildlife using surrounding areas. Therefore, the noise issue has been dropped from further consideration.

Recreation: *Could the proposed mining activities interfere with recreational opportunities or other management goals within the Elkhorn Cooperative Management Area?* The Elkhorn Mountains are a heavily used recreation area for area residents. Recreational use of the surrounding areas is increasing as the population of the surrounding area increases. The Elkhorns attract recreationists from the Butte, Bozeman, Helena, and Townsend areas.

Recreational use of the Elkhorns would increase as a result of general population growth as well as from incoming workers for the proposed project. However, comments received during the public scoping process did not identify recreational impacts as an area of concern. DEQ has concluded that the proposed mining operation would not have a major effect on area recreation other than the threat posed by increased traffic on Indian Creek Road. This issue is addressed under traffic safety, Issue 2, earlier in this chapter and under Transportation in Chapter 4.

Socioeconomics: *Would the proposed project increase the number of people living and/or working in the area? Would such an increase in population affect community services, fire and police protection, garbage collection, and housing availability? Would the activities increase conflict with others (social systems, recreationists, etc.)?* Up to 69 new employees would be hired most of whom (and estimated 80 percent, or 55 workers) would be local residents hired. The remaining 20 percent, or 14 workers and their families, would result in small increases in the needs for housing, community services, and school enrollment. Local fiscal requirements to support minor increases in government services would be partially offset by increases in tax revenues. Although the project does not trigger a requirement for development of a Hardrock Impact Plan due to its small workforce (fewer than 75 employees), Pegasus has indicated a willingness to work with the county to mitigate fiscal impacts resulting from development of the Diamond Hill Mine Project (John Fitzpatrick, Pegasus Gold Corp., personal communication at the scoping meeting, April 27, 1995).

The immigration of 14 new workers and families into Townsend and Broadwater County would not generate conflicts with the various social systems and recreational opportunities in the area. When considered cumulatively with the general population increase from retirees and new workers moving to Townsend and commuting to Helena, the impact would be somewhat greater, but still relatively minor.

Stormwater Reservoir Design/Stability: *Could existing historic underground workings weaken the proposed stormwater reservoir and cause failure?* Pegasus will evaluate the underground workings with regard to the construction and operation of the stormwater reservoir and will analyze the overall operational stability of the facility. DEQ would review final design plans and construction would commence only after agency approval. No significant impacts are anticipated (see Subsidence below).

Subsidence: *Could the proposed underground workings cause subsidence at the surface? How would such subsidence affect resources such as vegetation and water?* The rock strength assessment for the Diamond Hill property consisted of a Rock Quality Designation (RQD) determination. RQD is an industry-recognized evaluation tool for rock strength based on the percentage of core recovered and represents an important first step in determining rock susceptibility to subsidence. RQDs for the various rock types at the Diamond Hill site exceeded 80 percent (max. = 100 percent) which corresponds to "good" rock quality. Rock of this determination usually exhibits strong compressive strength and has the ability to stand unsupported for decades. This is demonstrated in the existing underground workings at the site, many of which are still open after decades with no artificial means of support.

A minimum amount of 100 feet of undisturbed rock is proposed to be left between the uppermost stope and the ground surface. This material is known as a "crown pillar." The pillars would provide support for the overlying rock and minimize the likelihood of subsidence. The mine plan calls for backfilling with waste rock and/or tailings any mined stopes located within 300 feet of the ground surface (Pegasus Gold Corp. 1995f). Thus underground there would be minimum section of 200 feet of backfilled stop overlain by 100 feet of in-place crown pillar above any man-made cavity.

Although the local host rock is strong, there is no definitive way of determining how long the unfilled stopes would remain open. Changes in the stress conditions of the surrounding rock would be the probable cause of failure. Stress changes would most likely result from a response to significant seismic even (earthquake) or long-term tectonic forces associated with mountain building. The potential stability of any underground openings could take hundreds of thousands to million of years to occur under these two scenarios.

In the unlikely event that the overlying backfilled stopes failed into the open lower stopes, subsidence at the surface could occur. If this happened while Pegasus was still operating the mine or before final reclamation was complete. Pegasus would take the appropriate safety measures. These measures include fencing and/or backfilling, regrading, and revegetating the disturbed area.

In the unlikely event of surface subsidence, the actual surface displacement would be minimal. Vegetation could still grow and may even flourish as the minor depressions could provide a water trap for surface run-off and precipitation. Groundwater would not be adversely affected as the water table is well below the ground surface.

Visual Quality: *Would the proposed activities adversely affect the scenery for recreationists?* The proposed mine disturbances will not blend in with the natural surroundings during mine operation. However, the entire area along Indian Creek, including the Diamond Hill site, has unreclaimed historic mining disturbances, and there are several other active, permitted mining operations in the area, including small placer operations and Continental Lime. Lights from the proposed mine and mill would be visible from the road similar to the situation at Continental Lime (DSL 1993). Pegasus plans to reclaim their exploration and mine disturbances as well as some historic mining disturbances before and after mine closure. These reclamation plans and mitigations would help the site visually blend with the surrounding landscape over the long term.

Waste Rock/Tailings Repository Stability: *Could the gradient of the hillside, where the proposed waste rock/tailings repository would be built, cause the waste rock/tailings repository to fail and cause waste material to reach the drainage leading to the West Fork of Indian Creek?* The

facility would have 2.5:1 slopes; it would be constructed and reclaimed from the bottom up; benches would be placed every 50 feet; and the tailings, if Phase III were implemented, would be compacted and capped prior to reclamation.

Stability analyses conducted for the waste rock/tailings repository identified a factor of safety of 1.9 for the waste rock/tailings repository under static (no forces other than gravity acting on repository) (Pegasus Gold Corp. 1995a, Appendix D). This implies the waste rock/tailings repository is not subject to spontaneous failure.

Stability analyses conducted for the waste rock/tailings repository assume that in the event of an earthquake a seismic force comparable to 40 percent of the force due to gravity (the association of seismic forces with the force of gravity commonly used in seismic design analysis) would be acting on the waste rock/tailings repository. A force such as this acting on the waste rock/tailings repository has a 10-percent chance of occurring in a 250-year span (Algermissen, et al. 1991). Analyses suggest that the waste rock/tailings repository could experience some slumping (less than 0.2 feet) along the crest surface in the event of an earthquake (Pegasus Gold Corp. 1995a). This, however, would not result in any of the waste material in the waste rock/tailings repository reaching the drainage leading to the West Fork of Indian Creek. Because the waste material in the waste rock/tailings repository would be "dry," it would not be susceptible to liquefaction during an earthquake, and hence would not flow. It would be more likely that the cap and liner might be compromised such that water could find a way into the repository potentially increasing seepage through the repository.

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CHAPTER 2 - DESCRIPTION OF ALTERNATIVES

This section is the heart of the Environmental Impact Statement (EIS). This chapter describes Pegasus' proposed action and reasonable alternatives that resolve significant issues and wholly or partially meet the purpose and need identified in Chapter 1, as well as the no-action alternative. This chapter contains sections on the development of alternatives, alternatives descriptions, alternatives considered but dismissed, reasonably foreseeable activities, comparison of environmental consequences, and the agency preferred alternative.

DEVELOPMENT OF ALTERNATIVES

In an EIS, DEQ is required to evaluate the environmental effects of the proposed action and reasonable alternatives to it. DEQ must also consider a no-action alternative.

Alternatives to proposed actions consist of reasonable modifications to various elements of the proposal, as well as mitigations. Modifications fall into two main categories: those that modify the location of facilities and those that modify or change the methods and procedures employed in the operation. Mitigations are activities or plans that are in addition to or supplement the proposed action. Mitigations can range from new or expanded monitoring plans to off-site activities which would compensate for impacts that could occur within the project area.

Potential financial impacts (Issue 1) to local government agencies resulting from development of a mine are usually handled through the preparation and implementation of a Hard Rock Impact Plan. However, this proposed project does not trigger this requirement of the Hard Rock Mining Impact Act (90-6-301 et seq., MCA) because the project would not have 75 or more employees. Pegasus has offered to work with the county to develop a plan to mitigate any financial impacts the development of the Diamond Hill Mine Project might create (John Fitzpatrick, Pegasus Gold Corp., personal communication at the scoping meeting, April 27, 1995). For these reasons, DEQ has not developed an alternative to mitigate financial impacts generated by the proposed project but will identify any potential financial impacts in Chapter 4.

DEQ developed one alternative other than Pegasus' proposed action and the no-action alternative in response to the identified issue of traffic safety (Issue 2). The intent of this alternative was to mitigate potential negative environmental impacts either by modification of the planned access route, modification of traffic procedures, or a combination of both.

ALTERNATIVES DESCRIPTION

No-Action Alternative

The no-action alternative represents the continuation of existing exploration activities at the Diamond Hill site. If DEQ determined that Pegasus' proposed project could not be developed in compliance with environmental statutes and regulations, then the permit application would be denied.

Under this alternative, Pegasus would not develop the Diamond Hill Mine Project. Pegasus could continue with permitted exploration and reclamation activities. The exploration operation would consist of the Marquis Portal, spiral decline, underground workings and drill stations, a vertical raise, office area, waste rock dump, drill pads, access roads, land application disposal area, and water collection ditches and ponds (Pegasus Gold Corp. 1993, 1994a, 1994b, and 1994d through h). If this alternative was chosen Pegasus would likely cease exploration operations immediately and proceed with formal reclamation and closure (Pegasus Gold Corp. 1995d). All facilities would be removed and reclaimed when exploration was completed.

Proposed Project

The following project description is summarized from Pegasus' application and completeness review responses (Pegasus Gold Corp. 1995 a through f). The proposed Diamond Hill Mine Project would be developed in three phases as follows:

- Phase I -- Mining 50,000 tons of ore and shipping ore to a mill near Jefferson City, Montana, operated by Montana Tunnels Mining, Inc., a Pegasus subsidiary, or another suitable contract milling facility.
- Phase II -- Expanded underground mine workings and operation, additional facilities such as crusher and loadout areas, additional infiltration gallery, expansion of the existing permitted waste rock repository, and trucking up to 2.2 million tons of ore to the Montana Tunnels mill or other suitable contract milling facility.
- Phase III -- Continued mine expansion and operation, construction of the waste rock and tailings repository and stormwater reservoir, and the development and operation of an on-site gravity flotation mill. The development of a gravity flotation mill complex at Diamond Hill would depend on the volume of ore reserves and grade, mining costs, trucking costs, milling returns and overall economics of the operation.

General Information. The underground mine would be located north of Indian Creek Road about one-half mile west of the confluence of Indian Creek and the West Fork of Indian Creek. The

ore body would be accessed through the Marquis Portal using the single spiral decline permitted under Pegasus' exploration license, #00237, and constructed in 1994.

Access to the Diamond Hill Project site would be via existing county roads. The primary route would be via Indian Creek Road from its intersection with Montana Highways 287/12 north of Townsend (see **Figure 1-1**). The Radersburg Road from Toston, Montana, to Crow Creek Road, then to Mud Springs Road which joins Indian Creek Road approximately 2 miles south of the project site would provide secondary access. Large truck traffic, including ore and supply delivery trucks, would utilize pilot cars and flagmen to minimize conflicts with the public on the county roads, especially in Indian Creek Canyon.

Roads within the permit area would be upgraded to a standard 20- to 40-foot width. Access to the mine site would be controlled by gates.

Phase I. Phase I would continue for 12 to 16 months. Of this there would be approximately 4 months of preparation and development, 1 to 2 months to commence mining, and approximately 6 to 10 months of active haulage to an off-site mill.

Phase I would not disturb any more area than has been approved for disturbance during exploration (10.4 acres) (see **Figure 2-1**). No additional soils other than those salvaged under Exploration License #000237 would be salvaged during Phase I because no additional surface disturbance would occur. A vertical raise (shaft) would be constructed from the lower portions of the decline to the surface for ventilation purposes during Phase I. The shaft might also be used in later phases to hoist deep ore to the level of the Marquis Portal for transport to the surface if economic conditions permit.

Pegasus would mine 50,000 tons of ore at a production rate of 500 tons per day or approximately 2,500 tons per week during Phase I. Ore would be trucked from underground load-out points to a stockpile area located within the footprint of the waste rock repository. Ore would be loaded from the stockpile area onto trucks for transport to the mill at Montana Tunnels or another suitable contract milling facility. The over-the-highway semi-tractor trailers with pups would be capable of hauling 25 tons of ore per load. This would result in up to 20 truckloads per day under Phase I. Ore trucks travelling between the proposed Diamond Hill Mine Project and the mill at Montana Tunnels would take Indian Creek Road to Montana Highways 287/12, west to Helena, 18 miles south on Interstate 15 to Jefferson City, and then 5 miles on Corbin-Wickes Road to the mill. Pegasus has committed to enter into an agreement with Broadwater County regarding the use and maintenance of county roads to transport ore under both Phases I and II production (Pegasus Gold Corp. 1995a).

Ore would be ground at the off-site mill, and the gold and silver would be concentrated by conventional flotation milling and gravity separation processes. No cyanide is used in ore processing at Montana Tunnels, the proposed mill. Tailings generated at the off-site mill would be deposited off-site at Montana Tunnels (or some other suitable mill) in accordance with its approved permit and reclamation plan (Operating Permit #00113). There would be no tailings deposited on-site during Phase I.

Approximately 90,000 tons of waste rock would be produced during Phase I. All waste rock generated during any project phase will be amended with crushed limestone to buffer the effects of acid generation. The waste rock would be placed within the footprint of the waste rock dump or repository permitted under the exploration license. The waste rock repository would be constructed in lifts with the less sulfitic lime-amended waste rock surrounding lime-amended highly sulfitic waste rock. The waste rock would be capped with a high density polyethylene-textured membrane and a lime-amended waste rock layer. Each lift of the waste rock repository would be resoiled and revegetated as it is completed.

Pegasus would backfill all stopes within 300 feet of the surface in the Faut, DeBeers, and Glory Hole zones with waste rock from underground or from the waste rock repository. Approximately 320 kilotons of waste rock could be used for backfilling these zones if mined during Phases I and II (Pegasus 1995f).

The existing diversion ditches and infiltration gallery system for run-on and run-off control installed during exploration would remain as constructed for Phase I implementation. Water flowing into the underground workings would be used underground for drilling. Excess water would be controlled through grouting or stored in underground sumps. The existing Land Application Disposal (LAD) area would continue to be used for Phases I and II. This area would be used to dispose excess water.

Power for the mine would be supplied by on-site diesel generators. The underground workings would require two 600 kilovolt amp (KvA) generators operating 5 days a week. There would be 20,000 gallons of diesel fuel storage at the portal (5,000 gallons for the generators and 5,000 gallons for equipment) (Connie Cole, Pegasus Gold Corp., personal communication to Kathleen Johnson, DEQ, December 22, 1995). The fuel storage area near the loadout area would contain 5,000 gallons of diesel fuel, 500 gallons of propane for heating the office, and 500 gallons of gasoline for vehicles (Pegasus Gold Corp. 1995d). All fuel would be stored in above-ground concrete storage tanks that do not require a containment berm.

An estimated 40 workers would be needed during mine development and construction. Employment would expand to a total of 51 people during Phase I. This includes 6 employees to truck

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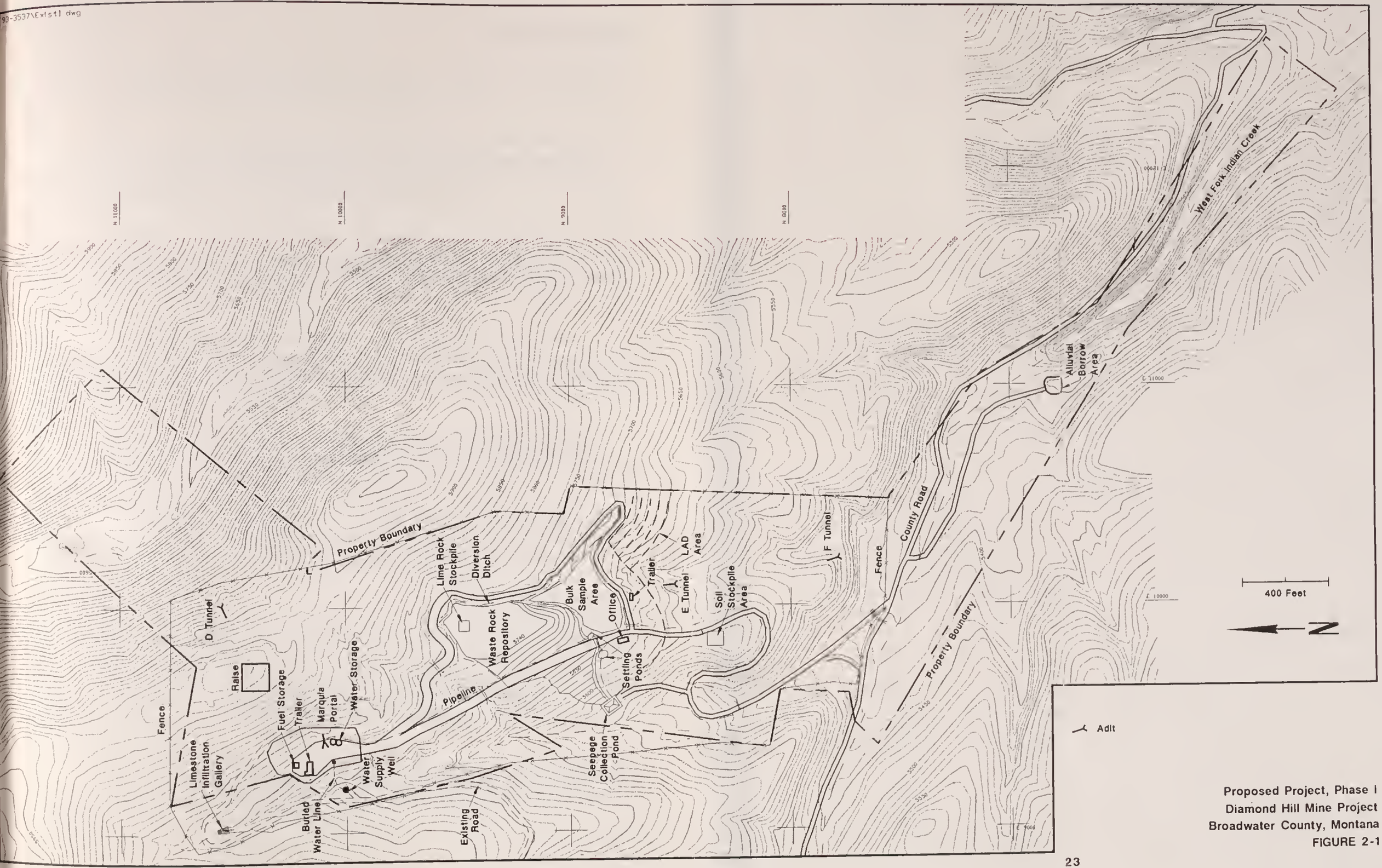


Proposed Project, Phase I
Diamond Hill Mine Project
Broadwater County, Montana
FIGURE 2-1

the ore to the Montana Tunnels mill near Jefferson City or another suitable contract milling facility. Pegasus proposes to bus employees to the site from Townsend.

Phase II. Phase II could last approximately 5 years and would disturb an additional 11.1 acres beyond that disturbed for Phase I (see **Figure 2-2**). The additional disturbance would result from developing an expanded truck loadout facility, crusher yard and stockpile, lime rock infiltration gallery, high-pressure misting pond, and an expanded waste rock repository.

Mine production would increase to almost 1,000 tons of ore per day during Phase II, with weekly production of approximately 7,000 tons. A total of approximately 2,160,000 tons would be mined based on current reserves (Pegasus Gold Corp. 1995a). Ore produced during Phase II would be stockpiled at the proposed crusher facility located south of the Marquis Portal (see **Figure 2-2**).

During Phase II, a truck loadout facility would be constructed adjacent to the crusher. Approximately 40 trucks per day would transport ore to the mill at Montana Tunnels in convoys of at least three trucks under Phase II. The tailings would be deposited at Montana Tunnels as is described under Phase I and Operating Permit #00113.

The waste rock repository would be expanded to store up to an additional 410,000 tons of waste rock during Phase II. The continued construction would proceed as discussed under Phase I. About 730,000 tons of waste rock would be produced during the life of the mine.

During Phase II, stormwater drainage from within the permit area would be routed to infiltration galleries. An additional infiltration gallery would be constructed to infiltrate stormwater associated with the crusher/loadout yard area under Phase II (see **Figure 2-2**). Pegasus would continue to use the LAD area.

Water flowing into the underground workings would be used underground for drilling. Should excess water be encountered underground that cannot be controlled through grouting during Phase II operations, water would be pumped to and contained in a synthetically lined storage pond near the crusher/loadout yard. The pond would have a synthetically lined beach area for use with a high-pressure misting system. The lined pond would be designed and constructed to contain approximately 300,000 gallons of water with 2 feet of freeboard sufficient to contain a 24-hour, 100-year precipitation event.

Power generation would be the same as for Phase I. Although fuel storage capacities would remain the same, fuel consumption would almost double due to increased mining and ore hauling rates.

Pegasus would employ a total of 51 employees to operate the mine during Phase II. The mine would operate two shifts per day during Phase II, 5 days a week, but trucking could occur 24 hours a day (Bill Banning, Pegasus Gold Corp., personal communication with Kathleen Johnson, October 21, 1995).

Phase III. Phase III would disturb a total of 37.2 acres. This increased disturbance would result from development of the mill and stormwater reservoir and the expansion of the waste rock repository into a waste rock/tailings repository (see **Figure 2-3**). Phase III could be implemented at any time depending upon Pegasus' economic and operational concerns. The most dominant factor would be ore reserves. The known amount and grade of known reserves would not be sufficient to cover the capital cost of a milling facility. However, if continued exploration identified sufficient quantity of new ore reserves, Pegasus would construct an on-site mill (Pegasus Gold Corp. 1995d).

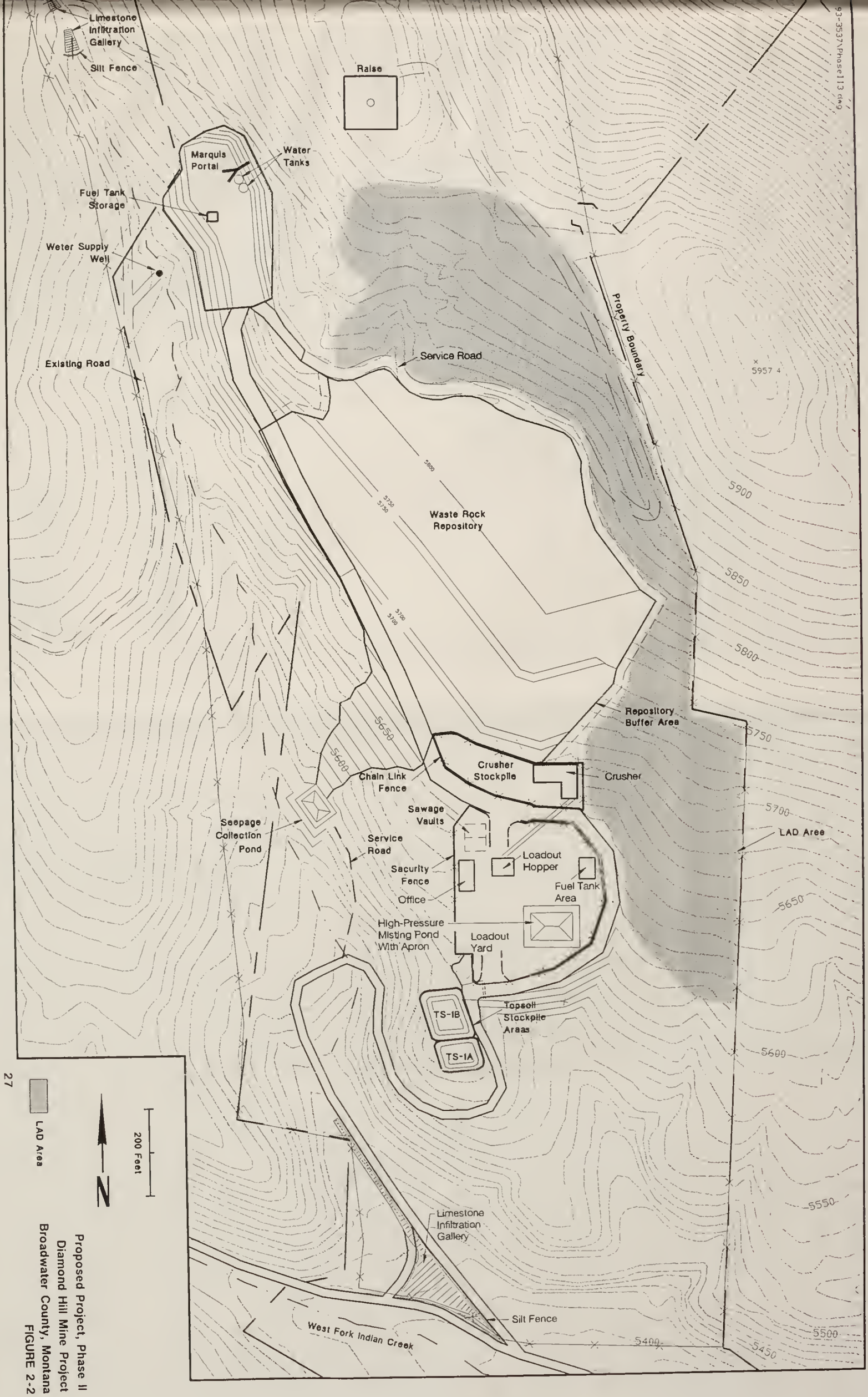
Following mill construction, the ore would be routed to a crusher located near the mill. Mining and milling of ore reserves would occur at a rate of approximately 1,000 tons per day, or 365,000 tons per year under Phase III. Although Phase III would not have any off-site ore transport, there would be up to 3 trucks per week[1] hauling gold and silver concentrate or dore' off-site for refining as well as supply trucks.

About 84,000 tons of waste rock would be used to construct the stormwater impoundment if Phase III was implemented. Any remaining waste rock generated during Phase III would be disposed of in the waste rock/tailings repository similar to the method described for the waste rock repository under Phase II. The repository was designed to hold 2,025,000 tons of material (waste rock and tailings).

If Pegasus decided to implement Phase III and build the mill at Diamond Hill, tailings would be placed on-site in the waste rock/tailings repository, and approximately 780,000 tons could be back-filled into the underground workings. Residual fine tailings (ground-up rock) remain in the flotation circuit after precious metals are removed from the ore. These tailings would be vacuum-pressure filtered to reduce the water content. Up to 1,400,000 tons of this filter-cake tailings, buffered with milk-of-lime during milling, could be generated during Phase III and placed in the waste rock/tailings repository in lifts. Each lift of the tailings placed in the waste rock/tailings repository would be mechanically compacted prior to capping and reclamation of the active face and surface.

During Phase III, stormwater draining from within the permit area would be diverted to and stored in a lined stormwater reservoir (see **Figure 2-3**). The stormwater reservoir would be designed

[1]Assuming a production rate of 10 tons per day and truck capacity of 25 tons, each truck would require 2.5 days of production per truckload, or 2.8 trucks per week.



Proposed Project, Phase II
Diamond Hill Mine Project
Broadwater County, Montana
FIGURE 2-2

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Revised May 1995

Proposed Project, Phase III
Diamond Hill Mine Project
Broadwater County, Montana
FIGURE 2-3

and constructed to contain a volume of 40 acre feet, which is approximately 90 percent of the average annual runoff plus a 100-year, 24-hour storm event (3.0 inches). This water would then be used for mine and mill make-up water. There would be no surface discharge of water from the permit area. Excess water encounters underground that is not needed for drilling would be pumped to and stored in the stormwater reservoir. Any excess water would be disposed of through land application or evaporated through misting on an impermeable apron/extension of the stormwater reservoir.

Power for the mine would be the same as Phases I and II. However, the mill would require two 1,360 KvA generators that would operate 7 days a week. All four generators would use up to a total of 2,360 gallons of diesel fuel per day during Phase III. Fuel storage at the mill area (crusher loadout area under Phases I and II) would be expanded to store 15,000 gallons of diesel fuel, 1,000 gallons of propane and 1,000 gallons of gasoline.

If Phase III was implemented and the on-site mill was constructed a total of 69 workers would be employed. The mine would operate two shifts per day during Phase III. The on-site mill would operate 24 hours per day, 7 days a week.

Reclamation/Mine Closure. Concurrent reclamation would occur on the waste rock or waste rock/tailings repository slopes as each lift is completed regardless of the phase of operation. Interim reclamation seeding would occur on the cut and fill slopes of access roads within the permit area during construction. Final reclamation activities would continue for up to 3 years after mine closure regardless of when the mine was shut down.

Salvageable soils within areas disturbed under Phases II and III would be hauled to areas being reclaimed or stockpiled in storage areas within the permit area. Alluvium from a nearby borrow area (see **figures 2-2 and 2-3**) would be direct-hauled for use as a growth medium when needed. Stockpiled soil and borrowed alluvium would be respread to a depth of 18 inches. Resoiled areas would be seeded and mulched.

Within 2 years after mining and ore processing operations were completed, final reclamation of the entire area would be done. If constructed, the on-site mill would be decommissioned as a part of reclamation. All buildings and other structures used for any operational phase would be removed. The Marquis Portal and raise would be plugged with concrete barriers and the openings backfilled and regraded to blend with adjacent undisturbed land. Roads would also be regraded to approximate original contour.

Residual water would be disposed of through land application and/or misting. Any sediment accumulated in lined ponds or the stormwater reservoir would be tested. The sediment may be pH-adjusted by the addition of cement and would be either disposed underground or encapsulated by

folding the sediment in the liner and burying the liner within regraded slopes of the pond or reservoir. After reclamation of the mine and mill facilities, the stormwater reservoir built for Phase III would then be regraded to allow free drainage.

Only 10 workers would be needed during final reclamation activities.

Mitigation Measures. Pegasus incorporated a number of other mitigation measures into the design of the Diamond Hill Mine Project not previously described above. The major measures are summarized below. Other mitigations for solid waste, scenic/aesthetic values, and project liaison with local governments are described in more detail in Pegasus' mine permit application (see Section 8.0).

- **Air Quality** - Diesel emissions would be kept to the lowest levels possible by regular service on all diesel-powered engines. Water or chemical treatment would be used as necessary to reduce fugitive dust emissions from road surfaces. Facilities would be reclaimed concurrently to reduce the potential for dust. Water or tackifier would be applied on the waste rock/tailings repository to control dust.

- **Hazardous Substances** - Hazardous materials are generally referred to as "hazardous or deleterious substances." These substances are regulated by numerous state and federal regulations (Clean Water Act; Clean Air Act; Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); Resource Conservation and Recover Act (RCRA); and Comprehensive Environmental Cleanup and Recovery Act (CECRA)). These substances are designated in 40 CFR (Code of Federal Regulations), Sections 116, 261, and 302. CECRA also includes petroleum products as hazardous or deleterious substances. These substances are regulated because their quantity, concentration, or physical, chemical, or infectious characteristics may pose an imminent and substantial threat to public health, safety or welfare or the environment.

  Pegasus would minimize the use of hazardous materials and would substitute less hazardous materials (containing more inert components) whenever possible. Absorbent materials would be kept on-site as specified in Pegasus' Hazardous Materials Spills Contingency Plan.

- **Fire Prevention and Control** - No open fires would be permitted on the project site. All internal combustion engines would be maintained in good working condition, with spark arresters and other safety measures intact. Fire extinguishers would be kept on-site and in good working condition. Hand tools, pumps, and heavy equipment would be available for fire control on the project.

- **Fish and Wildlife** - Although no critical wildlife habitat has been identified in the project area, measures would be taken to avoid impacts or conflicts with wildlife. Wildlife fencing would be used to restrict wildlife from the stormwater reservoir and mill pond and avoid damage to and from slippery geomembrane liners. Best Management Practices (BMPs) would be implemented to prevent sediment from reaching Indian Creek and the west Fork of Indian Creek to avoid impacting aquatic life using those streams. Netting would be used over the mill pond, if the on-site mill was constructed, and/or the waste rock/tailings repository seepage collection pond if the water was determined to be potentially hazardous to wildlife or birds.

- **Historic and Archeological Sites** - These sites would be avoided or preserved in place whenever feasible; however, some surface features (e.g., old mine waste dumps and tailings) have already been removed to facilitate reclamation and water quality control efforts during exploration. Pegasus would recover artifacts, map and photograph or otherwise record features and analyze any materials recovered during operation, in compliance with legal standards.

- **Noxious Weed Control** - Pegasus would continue to spray noxious weeds within the permit area and to reduce the potential for further spread of noxious weeds with BMPs and interim reclamation of soil stockpiles, fill areas and other disturbances. No hay or straw would be used for mulch unless it was certified weed-free. Pegasus would continue to work closely with Broadwater County to provide weed control in areas surrounding the permit area.

Monitoring Plans. Pegasus would conduct monitoring of environmental resources within and near the proposed project area. Monitoring would be conducted for surface water and groundwater quality, air quality, acid-generation potential of waste rock, and compaction and moisture content of graded tailings.

Water resources monitoring would consist of a network of five monitoring wells and five surface water monitoring stations. In addition, Pegasus would sample the water in the stormwater reservoir (Phase III only) before each major land application event and monitor water entering the mine workings.

Mitigated Project

All components of Pegasus' proposed project would remain the same under Alternative II. The only additional mitigations required would address the issue of off-site traffic safety.

Pegasus would work with Broadwater County and the Bureau of Land Management (BLM) when to develop measures to allow all mine-related traffic to safely drive through Indian Creek Canyon and along upper stretches of Indian Creek Road near the mine. These measures could include, but would not be limited to, the following items:

- Working with the county, BLM, and Continental Lime to develop a temporary, private-use road on the existing Black Diamond Mine Road and over to Indian Creek Road above the transfer station. This road would be used only for Pegasus' ore hauling trucks and would be reclaimed when the Diamond Hill Mine was closed and reclaimed.

- Using other existing roads, such as the Radersburg Road, in order to by-pass the Indian Creek Canyon when hauling ore to the Montana Tunnels mill.

- Assisting the county to widen upper portions of Indian Creek Road above the canyon to provide, at a minimum, turnouts to allow safe passage of public and large mine vehicles and to improve portions of the road through Indian Creek Canyon where the county determines improvements are feasible.

ALTERNATIVES CONSIDERED BUT DISMISSED

Pegasus considered several alternatives or options when designing the Diamond Hill Mine Project. These included alternate off-site or adjacent mill sites, metallurgical recovery systems, mining methods, waste rock and/or tailings disposal methods and locations, and water handling systems (see Pegasus Gold Corp. 1995a, Section 7.0). DEQ did not consider any of these alternatives further because they did not address the significant issues driving alternative development of this draft EIS.

DESCRIPTION OF REASONABLY FORESEEABLE ACTIVITIES

The following activities could reasonably occur within the next 5 to 10 years and could cumulatively impact the environment in conjunction with the possible development of the proposed project. Where an environmental document is available, it is summarized, and the potential cumulative impacts which might have a bearing on the proposed project are discussed.

Powerline Extension to Diamond Hill

Pegasus has applied to Montana Power and BLM for a 2.5-mile long 100 Kilovolt powerline with a 60-foot right-of-way to provide direct electrical power to their proposed Diamond Hill Mine.

This powerline would tap into Montana Power's line at SE 1/4 NW 1/4 Section 28, T7N, R1E then proceed southwest through Sections 29, 32, and 31, and then west through Section 36, T7N, R1W to the proposed project (BLM, 1995). The powerline would cover 18.14 acres, and the substation would disturb 4.44 acres. BLM is preparing an EA for the powerline proposal.

Broadwater Rod and Gun Club

The new Broadwater Rod and Gun Club facility is located southeast of the transfer station on approximately 20 acres of land BLM leased to the county. This facility is on Indian Creek Road below Indian Creek Canyon. The club has a 10-year lease from the county. The facility currently consists of five 50-by-100 yard lanes with shooting stations, a bullet-catching berm, access road, parking lot, and port-a-potty. The facility has greatest use by members during evenings and weekends. Use is lowest during hunting season. (Tom Campbell, Broadwater Rod and Gun Club president, personal communication with Kathleen Johnson, DEQ, October 11. 1995)

The club has plans to add five more lanes up to 600 feet long, which would be located partially on BLM lands, as well as trap-shooting stations and a club house. The club plans to hold shoot or competitions several times a year during evenings or weekends. Forty to 50 people might attend these events.

Reintroduction of Bighorn Sheep

The *Final Environmental Assessment and the Decision Notice of the Reintroduction of Bighorn Sheep into the Elkhorn Mountains* (Montana Department of Fish, Wildlife and Parks 1995) assesses the impacts of reintroducing bighorn sheep into winter ranges along Crow Creek and north of Indian Creek, which are respectively to the southwest and northwest of the proposed Diamond Hill Mine Project. It was anticipated that the sheep would occupy the predicted ranges due in part to habitat suitability, adjacent summer range, lack of significant overlap with other grazing ungulates (elk, deer), and carrying capacity. Road closures proposed in the Elkhorn Mountains Travel Management Plan (USDA Forest Service and USDI BLM 1995) would help provide additional security for wintering bighorn sheep, as well as deer and elk, but were not essential to the success of the reintroduction project. It was unlikely that the number of wildlife viewers would ever approach the peak traffic use on Indian Creek Road that occurs during big game hunting season. Methods such as wildlife fencing used to inhibit elk and deer from occupying reclamation sites also would address similar problems caused by bighorn sheep. Haul truck safety hazards were not anticipated to be a problem to bighorn sheep.

Vegetative Treatment of USDA Forest Service and BLM Land in Greater Crow Creek and Indian Creek Drainages

The *Environmental Assessment and the Decision Notice and Finding of No Significant Impact for Crow Creek Vegetation Treatment and Allotment Management Plan Revisions* (USDA Forest Service and USDI BLM, 1993b and 1994) assesses the impacts of treating grassland and conifer habitats with a combination of prescribed burning, thinning, and underburning as well as revising grazing allotments. The goal of the alternative to be implemented by the Forest Service and BLM is to achieve measurable improvement toward desired vegetation and stream conditions within 5 years. Follow-up treatments will be analyzed in the future to continue to move toward desired resource conditions. The alternative was developed to address issues of big game species and soil and vegetation conditions. Prescribed burning will be done on approximately 1,350 acres of grassland/sagebrush habitats and 2,850 acres of grassland sites containing unnatural levels of conifer invasion. An estimated 2,457 acres of conifer stands will be underburned. Where feasible, Christmas trees, boughs, and post and pole products will be sold and removed prior to burning treatments.

The Forest Service will revise the North Crow, South Crow, Pasture, and Kimber/Diorite grazing allotments. BLM will incorporate riparian guidelines for specific sites in the Limestone Hills and Kimber/Diorite allotments. BLM will construct approximately 2.8 miles of barbed wire fence along Indian Creek to enlarge an existing enclosure and to divide an existing pasture into two pastures.

Approximately 4 miles of road would be closed during hunting season (October 15 to December 1). These closures would involve 3.25 miles on Sagebrush Road and 0.9 miles on Power Gulch Road.

While the EA did not identify any significant cumulative impacts, several of the units proposed for treatment and revised allotments surround Pegasus's proposed Diamond Hill Mine Project. Prescribed burns, regardless of location, would generate small amounts of smoke which would drift into the project area but were predicted to disappear within an hour or so. The improvements to elk habitat are more than a mile to the north, west and east of the proposed project area and improvements to mule deer and antelope ranges are east of Diamond Hill. The primary indirect impact might be a slight increase in hunters using Indian Creek and West Fork of Indian Creek Roads which could contribute to decreased traffic safety during hunting season.

ECMA Traffic Management Plan Revisions

The *Elkhorn Mountains Travel Management Plan Environmental Assessment* (USDA Forest Service and USDI Bureau of Land Management, 1995) assesses the impacts from four alternatives: the proposed action, no action, and two alternatives to the proposed action. This plan identifies which nearby roads are subject to seasonal road closures. Although none of the access roads to Diamond Hill Mine Project would be closed, some roads beyond the project might be closed depending upon which alternative is selected. This EA indicates that the Diamond Hill Mine Project potentially would affect the North Crow elk herd and its winter range areas as well as elk security areas due to increased human disturbance and encroachment, additional roads, and increased traffic; however, the impacts are unknown. Similarly, the proposed project, in conjunction with a proposed expansion at Continental Lime, could impact the timing and movement patterns from summer/fall range to winter range for some mule deer. Although there were no anticipated impacts to bighorn sheep, wildlife viewing on winter ranges may become popular and pose a traffic problem on Indian Creek Road. Increased mine-related traffic could contribute to traffic safety problems and may increase disturbance to the point of displacing sheep.

COMPARISON OF ENVIRONMENTAL CONSEQUENCES

All alternatives would result in impacts of varying magnitude, duration, and importance in some resources. These impacts would be generally short term, minor, and not significant. However, impacts to government services and finances, and traffic safety have the potential to be fairly major in the short-term and could have some longer-lasting but still insignificant effects.

Issue 1: County Economics - *Would the development or disapproval of the mine affect revenues for Broadwater County?*

Development of the Diamond Hill Mine would generate 51 to 69 new jobs. The resulting tax revenues generated by the mine (approximately $1.2 to $2.0 million total) and potential increases in property tax revenue and income taxes from mine-related direct and indirect employment would provide some economic boost to Townsend, Broadwater County, and the Broadwater County School District funds and would help offset burdens from increasing needs for government services. Pegasus agreed to work with these three governments (as well as Jefferson Co. for Phases I and II) to develop a plan similar to that required by the Hard Rock Impact Act for larger operations to mitigate mine-related financial impacts to these government bodies.

Issue 2: Traffic Safety - *Would the additional mine-related traffic cause dangerous conditions in the canyon and upper portions of Indian Creek Road and Montana Highways 287/12?*

The number of employees would range between 10 and 69 depending upon the phase of operation or reclamation. Employee busing and supply and delivery vehicles would result in an estimated 5 to 10 vehicle round trips per day. The greatest increase in traffic would be generated by hauling ore from the Diamond Hill Mine to Montana Tunnels or another suitable milling facility. This would range from 20 trucks per day during Phase I (approximately 7-8 months) to approximately 40 trucks per day during Phase II, resulting in more than five times the traffic[2] during the high-use hunting season. The greatest impact on traffic safety would occur during Phase II during hunting season.

Mitigations proposed by DEQ could minimize traffic safety concerns if an alternative ore hauling travel route to the Indian Creek Canyon portion of the road could be developed. The potential mitigations discussed earlier in this chapter, which must also be developed and coordinated with Broadwater County and BLM, would increase traffic safety and reduce the risk of accidents by rerouting the ore traffic to other roads with less use and away from the canyon. The mitigated project would not reduce the number of ore trucks. Long-term impacts on traffic safety would depend upon which mitigations were worked out with the county and BLM. None of the mitigations except widening the upper portion of the road or providing pullouts, would have any long-term effects. This latter mitigation has the potential to provide greater traffic safety and reduce the risk of accidents along Indian Creek Road in both the long- and short-terms.

AGENCY PREFERRED ALTERNATIVE

The agency-preferred alternative is the mitigated project. This alternative would have the greater opportunity to improve traffic safety along Indian Creek Road. However, the development of these mitigations depends upon cooperation and agreement between Pegasus, BLM, Broadwater County and possibly Continental Lime. DEQ prefers the traffic safety mitigation which involves some improvements to Indian Creek Road in conjunction with ASARCO's proposed transportation plans. This alternative would result in the expansion of the existing exploration decline and waste rock dump, construction of an addition infiltration gallery, the hauling of ore to Montana Tunnels or another suitable milling facility, and when the mine's economics permit, the development of a mill, stormwater reservoir, and waste rock/tailings repository.

[2](22.7 existing vehicles per day) + (40 ore truck per day round trip = 80 vehicles per day) = (estimated 20 vehicles per day for employee buses and supply trucks) = 122.7 total vehicles per day during hunting season under Phase II, which is equal to an increase of 100 vehicles per day (440 percent).

CHAPTER 3 - AFFECTED ENVIRONMENT

INTRODUCTION

The following sections summarize the baseline conditions for the resources within the affected environment at the Diamond Hill Project area. Discussion is limited to only those resources which potentially could be impacted by the proposed action. Any information from other resource areas needed to discuss impacts will be discussed where needed in the document.

AIR QUALITY AND CLIMATE

Air quality data indicate particulate levels well within the Montana and federal PM-10 standards and typical of ambient background levels within western Montana (Pegasus Gold Corp. 1995a, Appendix K).

Climatological data revealed westerly winds being the most common in the project area. The mean annual air temperature is 37 degrees Fahrenheit. The average annual frost-free season is 60-90 days. Elevation within the project area ranges from 5,370 to 5,960 feet above sea level. The project area is in the rain shadow on the east side of the Elkhorn Mountain Range. Precipitation at Townsend over the past 20 years has ranged from 7.4-16.6 inches (average of 12-14 inches) (Pegasus Gold Corp. 1995a, Appendix C). Site precipitation at the Diamond Hill area in 1989 and 1990 was 26 percent more than the precipitation received in Townsend. Highest monthly totals are from March through August.

GEOLOGY AND TOPOGRAPHY

Topography consists of moderate to steep slopes (20 to 60 percent) with aspects to the east and northwest. Original topography has been altered by the existing exploration waste rock dump which appears as an engineered structure.

The precious metal deposit is hosted in skarn formed along/near the contacts of igneous rocks and a younger magmatic intrusion called the Silver Wave stock. "Skarn" is a term generally reserved for rocks composed mostly of lime-bearing silicates, derived from limestones and dolomites into which large amounts of silica, aluminum, iron and magnesium have been introduced by mineralizing fluids.

A stock is formed by the upwelling of magma from deep within the Earth. The magma rises because it is hotter than the solid rock around it. When the magma comes close to or extrudes onto the Earth's surface, the molten material crystallizes and forms different types of igneous rock. When the stock intrudes the Earth's crust from below, the heat from the magma heats water in the

surrounding rock and metals are mobilized. Metals moving in solution migrate until temperature, pressure, or chemical variations cause the metals to precipitate as solids. As these hot fluids migrate through the rock, they dissolve/replace the carbonate minerals, resulting in deposition of calcium-rich silicates or skarn.

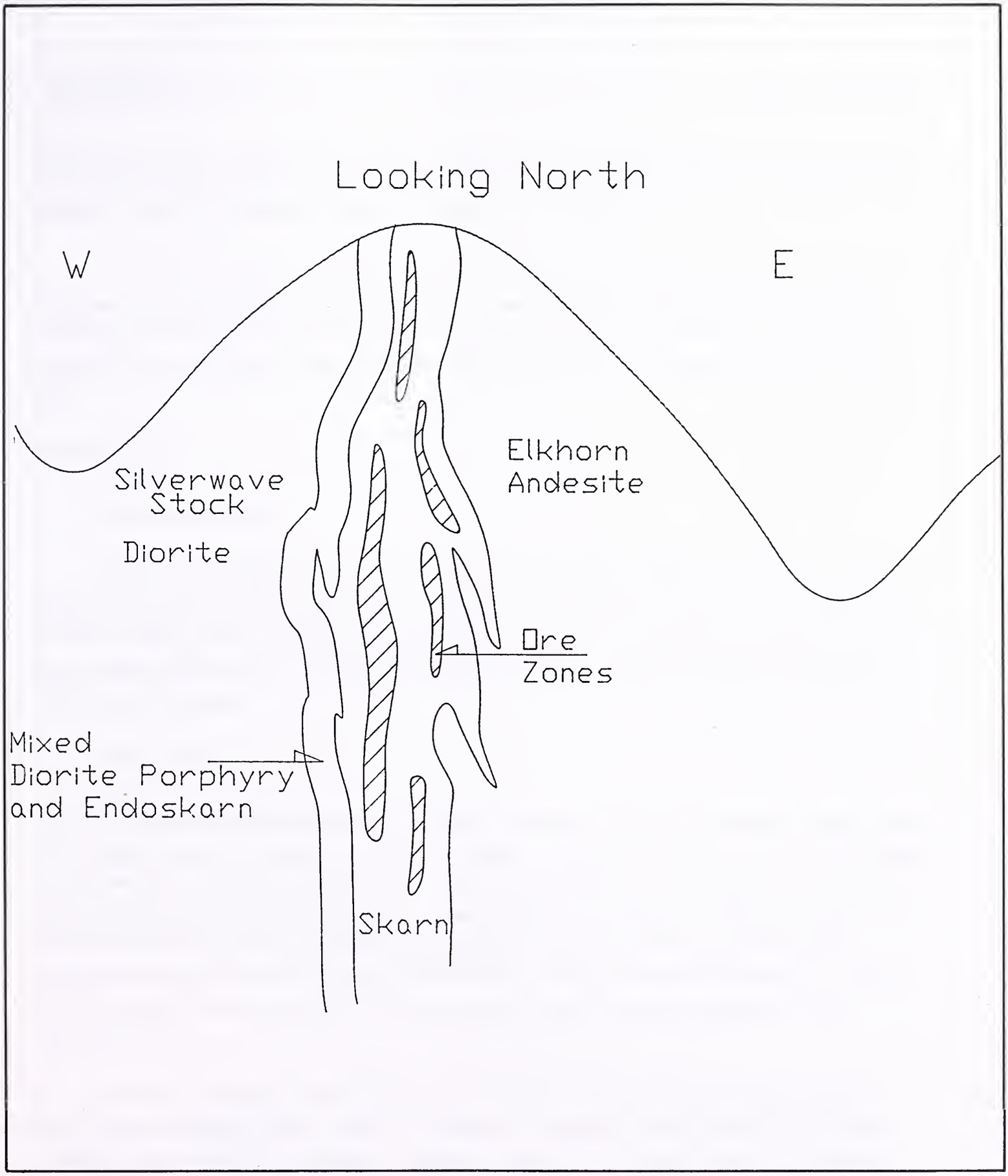
The major igneous rock types are the Silver Wave stock diorite and mixed diorite porphyry and the Elkhorn andesite (see **Figure 3-1**). The igneous rock types vary from dense, weakly fractured diorite with very fine fractures and veinlets of pyrite/calcite/quartz to less dense sometimes highly fractured andesite with veins and veinlets or pyrite/calcite/quartz. The pyrite (fool's gold) content varies from 0 to 15 percent in rock core. The degree of oxidation varies across the geology of the site. Rock containing sulfides at depth is usually unweathered and unoxidized.

Acid is produce when pyrite oxidize. The various rock types have been tested to estimate their respective acid-producing potential. Static acid-base account testing was conducted for 210 rock samples, including all dominant rock types associated with the deposit. Sampling and testing were carried out under the exploration license. The spiral decline was systematically sampled and rock types tested for acid-producing potential (AP), neutralizing-potential (NP), net neutralizing potential (NNP = NP - AP), total sulfur and calcium carbonate, and in some cases paste pH. Also, a series of samples was subjected to kinetic testing where hot, moist air is circulated through a cell filled with rock. Periodically the cell is leached with a volume of water and the leachate is collected and analyzed for various parameters (Saskatchewan 1992). Results are presented in detail in Appendix B of the permit application (Pegasus Gold Corp. 1995a). The skarn and endoskarn had markedly more negative NNP results when compared to the other rock types. These static results indicate a potential for acid production. Kinetic results from the skarn indicate this rock type to be slowly reactive even though substantial carbonate is present. The carbonate would buffer the acid produced in the short-term, but the rock could lose all its buffering capacity over the long-term.

The diorite had slightly positive to negative net neutralization potential in general, plus 20 to minus 20 tons $CaCO_3$ equivalent per kiloton of waste rock, indicating a potential to generate acid. However, this rock type did not produce significant sulfate when subjected to kinetic testing, indicating very little acid-production potential. Overall, the waste rock samples are slowly reactive. The rock types contain a source of readily available alkalinity that was not depleted during the tests.

However, results from kinetic testing are not considered representative of potential long-term equilibrium conditions that could develop upon depletion of sources of readily available alkalinity. In the long-term, the skarn, endoskarn, and diorite exhibit the potential to generate acid.

Several metals contained within the waste rock samples were leached from the samples under non-acid-generating conditions during the initial test cycles. These include selenium, arsenic,



Not To Scale

Typical Geologic Cross Section
Diamond Hill Mine Project
Broadwater County, Montana
FIGURE 3-1

cadmium, chromium, copper, nickel, lead, tin and vanadium. All tests indicate sustained leaching of barium and manganese at low concentrations under non-acid-generating conditions. Leachates from the skarn sample also indicated sustained leaching of boron and zinc.

No areas or zones of consistent strong, open fracturing were noted in the area. The skarn associated with this replacement deposit is a dense, competent mass of calc-silicate minerals that routinely produced 5 to 10 feet of solid drill core sections. Altered rock near and within the skarn bodies is dense and silicified with varying degrees of fracturing that are predominantly fine to very fine.

HYDROLOGY

Water Uses/Rights

There is only limited water use in the vicinity of the Diamond Hill mine. Review of water rights records indicates most designated water uses are/were for mining purposes from surface water sources, including Indian Creek and its west fork. An irrigation use and stock use are also listed as water rights on Indian Creek. The only designated groundwater uses in the project area are for the BLM from two springs.

Surface Water

Instantaneous streamflow data show that Indian Creek just above the confluence with the west fork of Indian Creek has ranged from 0.24 to 10.6 cubic feet per second (cfs) or 110 to 4,760 gallons per minute (gpm). The West Fork of Indian Creek near its confluence with Indian Creek has ranged in flow from approximately 15 to 400 gpm. Flows generally were higher in 1993 than in 1989 to 1990 and 1994 because of the exceptionally rainy summer season of 1993. The flow data also indicate that Indian Creek and its west fork gain in flow in the upper reaches but lose flow to valley alluvium where the two creeks join. This is due in part to placer mining disturbance that has occurred in the area.

The Marquis Portal is located approximately 2,000 feet west of Indian Creek and 2,500 feet north of the West Fork of Indian Creek. No hydraulic connection to these surface water drainage systems has been indicated by drilling or exploration decline advancement to date. The exploration decline has extended to depths below the elevation of Indian Creek with no indication of changes in mine water adit inflows.

Indian Creek and the West Fork of Indian Creek have similar water chemistry. The surface water is a calcium-bicarbonate type with a moderate specific conductance (SC) of 170 to 260

micromhos per centimeter (μmhos/cm) and a moderately alkaline pH of 7.3 to 8.3. Sulfate (26 to 56 milligrams per liter (mg/L) and nitrate plus nitrite (0.02 to 0.52 mg/L) concentrations are relatively low. Water temperature ranged from 7 to 32 degrees centigrade and hardness is moderate (73 to 134 mg/L as $CaCO_3$). Total recoverable metals in stream samples were low with the exception of arsenic (0.064 to 0.081 mg/L) in Indian Creek at one station.

Ephemeral surface flows and the spring in Portal Gulch show SC, sulfate, and hardness concentrations approximately twice that found in Indian Creek and its west fork. Concentrations of metals are low; however, iron and manganese occur at concentrations of up to 4.2 and 0.25 mg/L respectively.

Groundwater

Groundwater at the project site moves primarily through bedrock fractures (Pegasus Gold Corp. 1995a, Appendix J). In addition, groundwater flows through relatively small alluvial deposits in Portal Gulch and along Indian Creek and its west fork. Depth to groundwater in the project area ranges from approximately 6 to 119 feet below ground surface. The groundwater table generally follows surface topography. Groundwater apparently flows in bedrock radially away from the topographic high formed by Diamond Hill. In alluvium, groundwater parallels surface water flow direction.

Due to the non-porous nature of the bedrock at Diamond Hill, most groundwater movement occurs near the surface within soils and weathered bedrock. Permeability decreases with depth as the effects of near-surface weathering decrease. This results in a resistance against downward migration of water into more competent bedrock. The decreasing permeability tends to deflect the flow of water laterally through the weathered zone. Therefore, the water table generally follows topography. Most of the water which does infiltrate down through this upper zone into the more dense, unweathered bedrock then flows along fractures and faults. Fractures which extend to the surface, or to overlying aquifers, may receive recharge in these zones then discharge the water at lower elevations if the fractures are continuous and if they again intersect either land surface or underground mine workings. Springs and seeps, or mine inflows, occur where such structures discharge.

At Diamond Hill, however, no springs have been mapped on the hillside. One spring exists within Portal Gulch, but it is located within the alluvial bottom of the drainage and therefore its source of water is likely from near-surface groundwater flows rather than discharge from deeper fractures in bedrock.

Based on results of four aquifer tests, inflows to the exploration decline, and observations of historic underground workings that display only minor water dripping and no outflow, the overall

permeability of bedrock at the project site is very low (transmissivity range of .003 to 30 square feet per day). Only minimal groundwater (5 to 15 gpm or less) has been encountered in the exploration decline.

Generally, groundwater in the bedrock is a calcium-bicarbonate type with an SC range of 300 to 800 μmhos/cm. Moderate sulfate concentrations of up to nearly 300 mg/L were detected. The water has a moderately alkaline pH of 7.2 to 8.0. The groundwater is also hard to very hard (150 to 360 mg/L as $CaCO_3$). Concentrations of dissolved metals and nitrate plus nitrite are low. Arsenic was detected in one groundwater sample at a concentration of 0.06 mg/L. Iron, manganese, and zinc also are occasionally measured above detection limits. Groundwater in alluvial material at the project site generally is similar in quality to the bedrock water.

SOILS

Soils in the project area have supported vegetation grazed by wildlife and livestock. The topography, climate, and elevation have precluded other agricultural activities in the area. Mining has disturbed several acres in the project area. Disturbances include roads, adits, drill pads, alluvial fill derived from dredge mining, and waste rock dump piles. Soil development is slow in the area and disturbed areas have recovered slowly from past disturbances. The soil temperature regime is frigid and the soil moisture regime is udic (the amount of stored soil moisture plus rainfall is approximately equal to or exceeds the amount of evapotranspiration). Soil salvage would be limited by steep slopes, rock content, and depth to bedrock.

Soils in the project area are derived primarily from andesite, diorite and syenodiorite parent materials and are gravelly and cobbly sandy loams. Even though levels of aluminum and manganese exceed favorable levels for agricultural soils, the existing native vegetation is healthy and vigorous (Pegasus Gold Corp. 1995a, Appendix H). Toxic effects from elevated aluminum and manganese levels are reduced because the pH of the soils ranges from 5.8 to 7.9. Rock content ranges from 15 to 65 percent by volume. Fractured bedrock was found as shallow as 19 and 27 inches.

Slopes in the Marquis Portal area and northern portions of the access road range from 40 to 50 percent. The sandy loam-textured soils and fractured bedrock are over 40 inches deep, well drained, and were formed in gravity deposited syenodiorite parent materials (Pegasus Gold Corp. 1995a, Appendix I). Rock cover on the soil surface ranges from 10 percent in swales to 40 percent on convex slopes. Rock content increases with depth in the profile. Surface soils are 7-12 inches deep. They are brown from organic matter accumulation and contain a considerable amount of rock fragments. Subsurface soils are 11 to 14 inches deep. They are more yellowish brown and even rockier than the surface soils. Subsoils deeper than 19 to 23 inches are lighter in color and rockier still.

The waste rock/tailings repository area is located at the head of a dry coulee or ephemeral drainage on 15- to 25-percent slopes. The sandy loam soils in the waste rock/tailings repository and the southern portion of the access road are shallow to moderately deep, well drained, and were formed in gravity deposited parent material derived from andesitic volcanic rocks. Rock cover of surface soils ranges from 20 to 30 percent. Surface soils are 3 to 5 inches deep, dark brown, and contain considerable rock fragments. Rock content increases with depth in the profile. Materials deeper than about 15 inches consist of approximately 80 to 95 percent fractured bedrock fragments.

Alluvium from the Indian Creek drainage disturbed by historic placer mining activities has limited organic matter content and a considerable volume of coarse fragments. The alluvium, where it has been placed on stable slopes, has revegetated naturally over many years since placer mining ceased in the area. Pegasus has recently used the alluvium for reclamation of exploration and historic mine disturbances in the area documenting the suitability of the material for use in reclamation programs.

RANGE AND VEGETATION

Climate, topography and elevation in the project area have limited use of the area by man for logging and agricultural activities. Vegetation in the area favors use by grazers such as cattle and elk. Past mining and mineral exploration disturbances are common.

The vegetation in the area is predominantly grassland and mountain big sagebrush/grassland with open Douglas fir forest on slopes above the West Fork of Indian Creek and ephemeral drainages flowing to the south (Pegasus Gold Corp. 1995a, Appendix L). Black cottonwood is present along West Fork Indian Creek and the lower end of Maslowski Gulch. The vegetation communities in the proposed mining areas are common in the foothills and mountains of southwestern Montana. The native plant communities are diverse. A total of 257 plant species were identified in the area.

The grassland types include a bluebunch wheatgrass/sandberg bluegrass type which is common in the area and constitutes the driest grassland type in the project area. Productivity of this type is reported to range from 300 to 500 pounds per acre, of which 70 to 80 percent is palatable native grasses.

The Idaho fescue/bluebunch wheatgrass type is very common and occurs on wetter areas and at higher elevations. Production ranges from 600 to 1,300 pounds per acre.

The big sagebrush/rough fescue shrub/grassland type is common in the area and is found on more mesic east aspects. The relatively low cover of rough fescue indicates that the area has been

historically heavily grazed by livestock. Productivity of this type ranges from 1,100-1,600 pounds per acre.

Three upland forest types dominated by Douglas fir are found in the project area. These types are co-dominated by bluebunch wheatgrass, Idaho fescue, and rough fescue. Most stands have an open overstory, although the stands in drainage bottoms and on east slopes have more tree cover. Production for all the forest types is low, reflecting low understory cover. Moisture appears to be the determining feature controlling stand development and composition.

Bottomland plant communities are uncommon in the project area and are characterized by one small wet meadow on the West Fork of Indian Creek, a black cottonwood/Rocky Mountain juniper type, and a quaking aspen community.

No plant species of special concern were found on the project area. Two noxious weeds are present: canada thistle and spotted knapweed. Weed control has been actively practiced on the site in the exploration phase to limit their spread on disturbed areas. Other noxious weeds, including dalmation toadflax and diffuse knapweed, can be expected to grow in the project area.

A wetlands inventory identified less than 1 acre of jurisdictional wetlands and waters of the US in the project area, mainly in Portal Gulch and along the West Fork of Indian Creek (Pegasus Gold Corp. 1995a, Appendix M). Many of the intermittent drainages and tributaries in the study area exhibit wetland hydrology, but wetland soil and/or wetland vegetation may not be present due to the steep stream gradients, incised channels, rapid runoff and coarse textured alluvial materials. These drainages are considered jurisdictional non-wetland Waters of the U.S. The majority of the study area exhibits waters of the U.S. drainages with no indication of hydric soils associated with these features.

WILDLIFE AND FISHERIES

Wildlife

The Diamond Hill Project area lies in a region that teemed with wildlife from prehistory through the 1830s. The trapping era began a period of exploitation that lasted until the early 1900s and witnessed the decimation of almost all major species, some of which (e.g., bison, mountain sheep, gray wolf, and grizzly bear) have never recovered (Pegasus Gold Corp. 1995a, Appendix N). Uncontrolled exploitation was reversed in the early 1900s. When modern management policies were initiated in the early 1940s, viable populations of most big game species returned. At present, the region encompassing the study area again supports good densities of a diversity of wildlife. The

Forest Service, BLM, and Montana Department of Fish, Wildlife, and Parks (DFWP) are in the process of reintroducing bighorn sheep into the Elkhorn Mountains (DFWP 1995).

Of the 274 birds, 62 mammals, 8 reptiles and 5 amphibians that have been recorded in the region, 160 to 180 birds, 40 to 45 mammals, 5 reptiles and 4 amphibians might occur in the habitats found in the wildlife study area. Of these, 117 species including 33 mammals, 37 birds, 5 amphibians, 4 reptiles and 19 invertebrates were delineated as important species in the study area by Diamond Hill wildlife consultants. Finally from these 117 species, 45 species including 22 mammals, 18 birds, 2 amphibians, and 1 reptile were chosen as major species to study in the project area. Ultimately, 90 species of birds, 26 mammals, 3 reptiles and no amphibians were recorded in the study area, indicating that the project area supports a good diversity of wildlife for the available habitat.

No federally listed threatened or endangered animal species are known to occur in the area. Three endangered species -- bald eagle, gray wolf, and grizzly bear -- may migrate through the area.

The only evidence of bat use documented was a few scattered droppings near the entrance to one old tunnel. The adit is a suspected night roost for a few bats. There is no evidence that any of the old workings are being used as day roosts, maternity roosts, or hibernacula. Most bats heard on the bat detector were the big brown bat, hoary bat, and the silver-haired bat. Four species of bats were captured, including little and big brown bats, a hoary bat and a long-legged myotis. These are common bats in Montana.

Fisheries

Aquatics were sampled in three ponds: Indian Creek, Portal Gulch, and the West Fork of Indian Creek (Pegasus Gold Corp. 1995a, Appendix O).

The Diamond Hill area and the north slopes of Giant Hill drain into the West Fork of Indian Creek. Portions of the West Fork have been disturbed by historical mining. In other reaches, the streambed is shallow and silty, with a limited riffle/run habitat. Portions of this reach were heavily used by cattle in 1990.

Since drainages below the project area do not support perennial flows and do not drain into good fisheries habitat, no further fisheries studies were undertaken. However, Pegasus has agreed to further aquatics studies in local streams. These studies would include the collection of macroinvertebrates at four stations: two stations on the West Fork of Indian Creek, one station on Indian Creek, and one station in Portal Gulch.

LAND USE AND RECREATION

The primary land uses in the Indian Creek/Diamond Hill area are livestock grazing, minerals development and extraction, and recreation. There are some homesteads in the area. There is no commercial timber harvest in the Elkhorns on national Forest Service lands, but commercial harvest can occur on BLM lands.

Timber harvesting is primarily limited to post and poles, Christmas trees, and firewood on federal lands. There is a U.S. Army National Guard training range in the Limestone Hills on BLM lands southeast of Diamond Hill.

There is one major mining operation, Continental Lime, Inc., located about 5 miles downstream on Indian Creek from the proposed Diamond Hill Project (DSL 1993). There are a few small placer operations in Indian Creek. The entire area has been subject to extensive disturbance from historic hardrock mining, including underground, placer, and hydraulic mining and panning for gold.

Recreation within the Elkhorns includes driving for pleasure, camping, hiking, fishing, hunting, cross-country skiing, snowmobiling and other off-road vehicle use, and back-country recreational activities. Recreational use is probably heaviest during weekends, holidays, and hunting season (October 25 to November 30). From 1982 to 1991, between 544 and 868 hunters (an average of 640 hunters) were interviewed at the Townsend check station during the opening two daus and closing two days of the general big game season (DeSimone, R. and J. Vore 1992).

TRANSPORTATION

Numerous county and private roads provide access to the Elkhorns from surrounding highways and interstates. Most of the roads and trails within the Elkhorns were developed primarily for mining operations in the late 1800s and later for commercial logging. The early wagon roads and pack trails were gradually improved to accommodate motorized traffic. Most roads are single lane, low standard roads. Road alignment is often poor and suitable only for low speed traffic. Additionally, the roads receive very little maintenance; as a result, the travel surfaces are rough. The Diamond Hill area is accessed primarily from the east from Montana Highway 287 via Indian Creek Road and from the south from Toston, Montana, via the Radarsburg, Crow Creek and Mud Creek roads. The canyon through which Indian Creek Road winds is very narrow with sharp curves and a couple of blind corners. Further up this road, the narrow roadbed borders a sharp drop of up to 100 or more feet to the creek and old dredge mine workings.

There are no accident records maintained for Indian Creek Road by the Broadwater County Sheriff's Office. However, there are probably a few unreported fender-benders each year (Mike Koehnke, Broadwater County Ambulance Service, personal communication with Kathleen Johnson, DEQ, January 10, 1996). There have been no fatal accidents along Indian Creek Road.

The Helena National Forest's 1980 traffic data for Indian Creek Road indicate that the average vehicle daily traffic (ADT) from May through September was 11.8 vehicles; from mid-October through the end of hunting season in December it was 22.7 vehicles (Pegasus Gold Corp. 1995). The overall ADT was 14.2 vehicles; the highest daily volume was 56 and the lowest was six. During the week, traffic through the canyon and above it is probably composed of people accessing mines and homesteads and checking on cattle. Weekend and seasonal traffic is greater due to recreational activities and hunting. Traffic is generally the heaviest during hunting season. Traffic below Indian Creek Canyon consists primarily of coal trucks to and lime trucks from the Continental Lime plant as well as commuting employees, county garbage container trucks going to the transfer station (eight to 10 trips per day), semi-trucks hauling garbage dumpsters away from the transfer station (one every other day), and visitors to the Broadwater Rod and Gun Club (Mike Masolo, Broadwater County, personal communication with Kathleen Johnson, DEQ, January 10, 1996).

Montana Highways 287 and 12 run northwest together from the intersection of both highways in Townsend. The seasonally adjusted annual average daily traffic count is 3,240 vehicles just outside Townsend. According to Tom Lithgoe of the Montana Department of Transportation, these numbers have been adjusted to reflect season, time of day, and other traffic-related variables (Pegasus Gold Corp. 1995b).

Trains blocking the railroad crossing on Indian Creek Road can cause traffic delays on Indian Creek Road and Montana Highways 287/12. Southeastbound highway traffic often pulls off on the shoulder while waiting to turn onto Indian Creek Road. Northwestbound turning traffic usually blocks traffic behind it over the Missouri River bridge because there is no turn lane to use while waiting to cross the railroad tracks or waiting for eastbound traffic to pass before turning (Mike Masolo, Broadwater County, personal communication with Kathleen Johnson, DEQ, January 10, 1996).

AESTHETICS

The Elkhorn Mountain Range is characterized by rounded ridges and steep slopes with rock outcrops. Grassy slopes and large open parks are interspersed with continuous conifer stands. Numerous creeks with their riparian vegetation offer striking fall colors. There are numerous gray limestone cliffs and rock outcrops in the Indian Creek Canyon area. Some caves are also evident. Most of the area has a moderate-to-high visual appeal.

Evidence of mining and off-road vehicle use is especially noticeable along Indian Creek Road. The landforms created by past mining activities are visually unrelated to the characteristic landscape. Lights from nighttime mine activities at Continental Lime are also visible from Indian Creek Road. Although mining has been an historic activity throughout the Elkhorns since the 1800s, the contrast in color, texture, and form is often incompatible with viewers' expectations for the area. Noises from blasting, mining and excavation equipment, and haul trucks generate additional aesthetic impacts on forest users.

The Forest Service and BLM attempt to minimize the visual impact of federal projects in the Elkhorns through careful location and repetition of the basic elements. The objectives of Management Class 4 for adjacent BLM lands and the modification visual quality objective (VQO) for adjacent National Forest Service lands allow for modification of the existing landscape (USDA Forest Service, 1993). In Class 4 areas, contrasting activities may attract attention and be a dominant feature of the landscape in terms of scale but should be consistent with the basic visual elements of the characteristic landscape (USDI Bureau of Land Management, 1983). The Forest Service modification VQO requires that human activities may dominate the characteristic landscape but must at the same time use naturally established form, line, color, and texture. They should look like natural occurrences when viewed in the middleground or background (USDA Forest Service 1974). .

BLM lands lie mostly within the foreground to middleground zone (up to 3 miles away) along major travelways into the Elkhorns. Forest Service lands encompass all viewing zones from foreground to background. Diamond Hill is within the foreground to middleground viewing zones from Indian Creek Road.

SOCIOECONOMIC CONDITIONS

Broadwater County is a sparsely populated agricultural county. Most land is privately owned. Townsend is the county seat and commercial center of the county. While the population as a whole in Montana grew 2.9 percent during the past decade, Broadwater County's population increased by 6.1 percent. Townsend grew by 3 percent in the past decade, but between 1990 and 1992, Townsend grew by 8.8 percent. Broadwater County is anticipated to grow another 23.9 percent by 2015 over the 1990 population level (Pegasus Gold Corp. 1995a, Appendix Q).

Mining has historically played an important role in the economy of the county. Discoveries of gold, silver, copper, zinc and limestone increased the demands for local goods, including farm products. As placer mines played out, many miners shifted to agricultural production, which became the dominant employment sector in the county. The Continental Lime, Inc., mine and plant are a major source of employment and tax revenue for the city and county (DSL, 1993). Timber harvesting and processing has also been an important industry in the county.

There are two elementary schools and one high school in Broadwater County. While school enrollment has been increasing, conversion of existing buildings into classroom space has kept student/teacher ratios below the state's accreditation standards. However, there were more than 800 students attending school in the 1995-96 school year, which fills all available classroom space (Jim Hone, Broadwater County Commissioner, personal communication with Kathleen Johnson, DEQ, October 17, 1995, and Broadwater County School District, 1995).

Law enforcement is provided by the Montana Highway Patrol and the Broadwater County Sheriff's Department. The Highway Patrol restricts its law enforcement activities to the state highway system, and the Sheriff's Department is responsible for the remainder of the county. The Sheriff's Department operates and administers the jail in Townsend. Broadwater County ranked 14th in all crimes committed among 44 counties reporting to the Montana Board of Crime Control in 1993 with major crimes declining.

Fire protection is provided by the Townsend Volunteer Fire Department, Broadwater County Rural Fire Department, the Montana Department of Natural Resources and Conservation and the USDA Forest Service. According to the ranking formulas used to evaluate fire risk, the number of volunteers, fire trucks, and equipment available is adequate for the size of the community served. The fire response providers have a mutual aid agreement to provide service to the various rural portions of the county, including a section in the south end of the county which is covered by the Three Forks Fire Department. The Broadwater County Rural Fire Department responded to a vehicle fire in the Indian Creek drainage in 1995.

Ambulance service is provided by a commercial service with two, fully equipped ambulances operated by the Broadwater Health Center, which is the only licensed hospital within the county. The area is adequately covered by the number of ambulance personnel and emergency vehicles. Rescue services are occasionally required to find lost hunter and recreationists. There has been only one medical emergency run to Diamond Hill to treat two injured miners in late 1994 (Mike Koehnke, Broadwater County Ambulance Service, personal communication with Kathleen Johnson, DEQ, January 10, 1996). The hospital physicians concentrate on family practice and minor surgery. Patients in need of emergency surgery are transported by ambulance or aircraft to the nearest hospital, that can provide the services, usually St. Peters in Helena. The hospital also operates a nursing home in a wing of the hospital. In addition, the county operates a small personal care facility in Townsend.

Community infrastructure in Townsend includes the municipal water supply obtained from three wells. The system is in good condition and could service three times the current population size. The municipal wastewater facility consists of a sewage lagoon, adequately sized for the current population with additional growth. The city is in the process of applying for an aerated lagoon

system to update their current process. Rural residents utilize individual wells to provide potable water and septic tanks for wastewater disposal.

Solid waste pickup in the city of Townsend is provided by the city for a fee and hauled to the county transfer station on Indian Creek Road for transport to the Logan landfill.

Townsend has been experiencing a shortage of homes and rental apartments. Developers are responding with increased construction of housing units and apartment complexes. Most of the existing housing inventory is composed of single family dwellings with 12 percent multi-family structures and 3 percent other units.

The average annual employment rate for Broadwater County is just slightly higher than the statewide average. The largest employment increases occurred in the agricultural, forestry, and fisheries sector, and the services industry and retail trade sector. The three largest employers in the county are the Broadwater County School District, Broadwater County government, and the Broadwater Health Center. Although per-capita personal income has been below the state average, the unemployment rate for Broadwater County has been below the state average for the past three years.

Local government financial affairs are administered by the county, city of Townsend, and Broadwater School District. County affairs are managed by the Broadwater County Commissioners. The mayor of the City of Townsend and the Town Council administer city government.

The most important source of revenue for Broadwater County is intergovernmental transfers. Total county expenditures increased between fiscal years 1991-92 and 1992-93 from $1,534,991 to $2,561,613, with major components being capital outlay and general government costs (Pegasus Gold Corp. 1995a, Appendix Q). Taxable valuation in the City of Townsend remained static during the study period, with mill levies remaining the same. Expenditures increased while revenues decreased, with public works and public safety the largest cost components for the city.

Expenditures in both the high school and elementary school districts exceeded revenues during the study period. In an effort to cut costs and be more efficient, in 1993 the high school and elementary school districts merged into a kindergarten through 12th grade school district. The recent growth in the number of school-age children may make it necessary for the school district to request additional mills within the next two years to expand the existing school buildings or build a second facility (Jim Hone, Broadwater County Commissioner, personal communication with Kathleen Johnson, DEQ, October 17, 1995).

CULTURAL RESOURCES

The Diamond Hill mine and mill site is eligible as an historic district for listing in the National Register under Criterion A for its important association with mining activities in the Hassel/Indian Creek area in the late 19th century. However, the district does not have associations with important persons nor does it reflect important technological developments in mining or milling technologies. Although the 120-stamp mill at Diamond Hill was one of the largest mills to be built in Montana in the late 19th century and one of only a few mills outside of the Butte/Anaconda area to rely on hydroelectric power, it does not retain sufficient physical integrity to depict the processes it employed.

CHAPTER 4 - ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

The agency's interdisciplinary review of the proposed project has identified limited impacts to several resource areas: geology, hydrology, transportation, and socioeconomics. These resource areas will be tracked through the environmental consequences section of the EIS. Other resource areas such as soils and vegetation are summarized and a rationale is provided about why DEQ did not carry the resource analysis further.

Whenever possible, qualitative terms are used to describe anticipated magnitude of impacts and, where appropriate, anticipated importance of impact to the human environment. *"Significant," "potential to become significant"* and *"insignificant"* describe importance. Impacts are considered to be insignificant unless identified otherwise. Discussions pertaining to unavoidable impacts, short-term uses versus long-term productivity, irreversible and irretrievable losses, and cumulative impacts are found at the end of this chapter. An evaluation of restrictions on private property is also included.

AIR QUALITY AND CLIMATE

As stated in Chapter 1 (Issues That Will Not Receive Further Consideration), air quality is predicted to stay well within federal air quality standards because of the small size of the overall project, regardless of whether the ore is trucked to a off-site mill or processed in an on-site mill.

The climate at the site is typical of foothill rain shadow zones on the eastern slopes of mountain ranges in southwestern Montana. Limited precipitation minimizes potential impacts to water resources. Discharge has been produced from historic mine openings and from old mine waste deposits in the Diamond Hill area. In contrast, however, the moisture would be adequate to allow successful revegetation of proposed disturbances in the area. Old mine waste deposits with limited physical problems such as steep slopes (greater than 2:1 or 50 percent) and neutral rock geochemistry have revegetated naturally in the Diamond Hill area.

Due to the small magnitude of impacts to or from air quality and climate under any alternative, air quality and climate impacts will not be discussed any further in this EIS.

GEOLOGY AND TOPOGRAPHY

No-Action Alternative

Under this alternative, the mine would not be developed and impacts would be limited to approved exploration disturbances. Topographic modifications would be limited to less than 11 acres.

Reclamation and revegetation of the waste rock repository would mitigate topographic changes as vegetation matures on the site, making it appear more natural.

Development of the geologic ore resource would be limited to exploration levels only. Geologic reserves would remain for future generations to recover if the economics of the deposit at that time warrant such action.

In the short-term, materials represented by waste rock samples would not be anticipated to rapidly develop acid-generating conditions unless exposed to an external source of acidity, such as acidic mine or mine waste drainage, that could consume buffering capacity (Muller, as cited in Pegasus Gold Corp. 1995a). Although most lithologies contain significant amounts of carbonate, the rock at Diamond Hill could produce acid and other contaminants over the long-term. This has been suggested by static and kinetic testing. The mitigations proposed by Pegasus would limit contaminant production and migration. However, due to the dry climate, low transmissivity of the country rock, the total lack of discharge from any existing adit, and the lack of seeps or springs in the area, significant acidic seepage or contaminant migration is not likely. If the phreatic surface was raised to the point that adit discharge did occur, the discharge would not be a surface expression but would be subsurface alluvial flow. Inherent in the alluvium and bedrock in this area is a higher carbonate content which would react to mitigate contaminant migration. However, barium, manganese, boron, and zinc may be expected to occur under non-acid generating conditions (Muller 1991, as cited in Pegasus Gold Corp. 1995a).

Sulfides in the exploration decline and in the 6.3 acre waste rock repository could be acid-producing. The surface areas of the waste rock left in place after mining could be increased due to fracturing associated with blasting. This could increase the available surface area of sulfides exposed to air and water and could increase the weathering rate of the intact rock. The mining company's approved exploration and reclamation plans include the addition of crushed lime to waste rock as it is deposited. Under the no-action alternative, limestone amendments to the waste rock repository would mitigate acid production and migration as approved under the exploration license environmental assessment (DSL 1994a and b). No tailings would be deposited on-site under this alterative.

Interpretation of static and kinetic testing results can be very subjective. In order to reduce the risk associated with improper placement of any reactive waste, the operator has proposed to amend any waste rock reporting to the surface so that the neutralizing potential equals at least 3 times its acid producing potential (NP/AP = 3) (British Columbia Acid Mine Drainage Task Force, 1989, Saskatchewan, 1992). This mitigation applies to all alternatives.

Proposed and Mitigated Projects

DEQ concluded that the mining company has proposed an acceptable plan to limit the effects on topography and geology at Diamond Hill, no further mitigations have been proposed which would affect geology or topography.

Under the proposed action, regardless of whether the mill was developed on-site or not, the total topographic modifications or disturbance would increase to 37.2 acres. Recontouring proposed in the reclamation plan would return all mine disturbances to approximately premine contours except the waste rock or waste rock/tailings repository. Reclamation and revegetation would mitigate topographic changes as vegetation matures on-site. The largest single topographic modification at Diamond Hill would be the waste rock or waste rock/tailings repository from the existing 6.3 acres up to 20.7 acres depending on the phase of mining. The waste rock and tailings repository is designed to hold up to 2,025,000 tons regardless of phase completed. Since the waste rock would be built in lifts from the bottom, the footprint would remain the same regardless of phase. Should additional ore be found, the waste rock dump could be filled to design capacity. If the mill was never built, tailings would not be produced on-site and the repository would not extend as far up the side of the hill. Regardless of the completion of any phase, the waste rock or waste rock/tailings repository would be recontoured to a 2.5:1 (horizontal to vertical) sidehill slope. However, to produce positive drainage controls on the waste rock/tailings repository and limit the potential for impacts related to weathering of sulfides in the repository, the mining company would construct diversion benches every 50 feet of vertical height for the repository. These benches would make the site appear as a man-made, engineered feature. The positive effects of the benches to other resources such as water, could outweigh the negative aesthetic visual effects. Soil replacement and revegetation would slightly reduce the visual effects of the benches over time.

Impacts to the geologic resource would increase under the proposed mining plan. More ore resources, if located, could be mined as long as the projected resource impacts addressed in this environmental document are not exceeded.Identified geologic reserves and those further delineated by continued exploration during mine life could be exploited as long as approved surface disturbance (limits (37.2), acres design capacities of the waste rock or waste rock/tailings repository are not exceeded. The ore could be milled on- or off-site.

Impacts from full-scale development of ore reserves would increase the amount of rock exposed to weathering. This includes rock left in place underground as well as waste rock brought to the surface for disposal. Also, milling would produce fine-grained tailings which could weather and react to produce acid, although the fine-grained nature of the tailings limits permeability and therefore oxidation. Pegasus has proposed mitigation to limit the effects on weathering on the geological resource, including:

1. continued identification and segregation of the most reactive waste rock;

2. selective placement of the most reactive waste rock and tailings in the core of the waste rock/tailings repository which has a limestone under drain;

3. continued amendments of lime to waste rock to mitigate acid production in-place, as approved and implemented in the exploration phase;

4. addition of milk-of-lime to the tailings before drying and placement in the waste rock/tailings repository;

5. placement of a geomembrane liner in the reclamation capping system to limit potential infiltration of moisture through the waste rock and to direct moisture to drainage diversions;

6. positive drainage control diversions placed every 50 feet of vertical height in the waste rock/tailings repository to limit erosion of the reclamation cover system and route excess water away from weathered rock, and

7. soil replacement and revegetation programs, as approved for the existing waste rock repository, to maximize evapotranspiration of water before it reaches reactive weathered rock at depth in the waste rock/tailings repository.

Reactive waste would be identified, tested, and amended based on its acid-base account. The prescribed amendment rate would be three times the calculated net neutralized potential (Saskatchewan 1992). If the tailings were disposed off-site or at Montana Tunnels, the disposal methods must also meet the reclamation requirements and capacities permitted in that respective operating plan (DEQ 1995). The waste rock/tailings repository would be capped with a low-permeability synthetic liner (see **Figure 4-1**) to limit the amount of infiltration of precipitation into any sulfitic waste rock placed at the surface.

No mitigations are proposed to limit weathering in the underground mine workings except to let the underground workings fill with water. This mine flooding will limit the diffusion rate of oxygen into the surrounding rock and therefore would markedly reduce the sulfide oxidation rate. If Phase III is implemented, backfilling underground workings with tailings would be conducted. The tailings would contain a limited amount of milk-of-lime. However, the effects of the milk-of-lime on groundwater quality at the mine site can be considered to be negligible.

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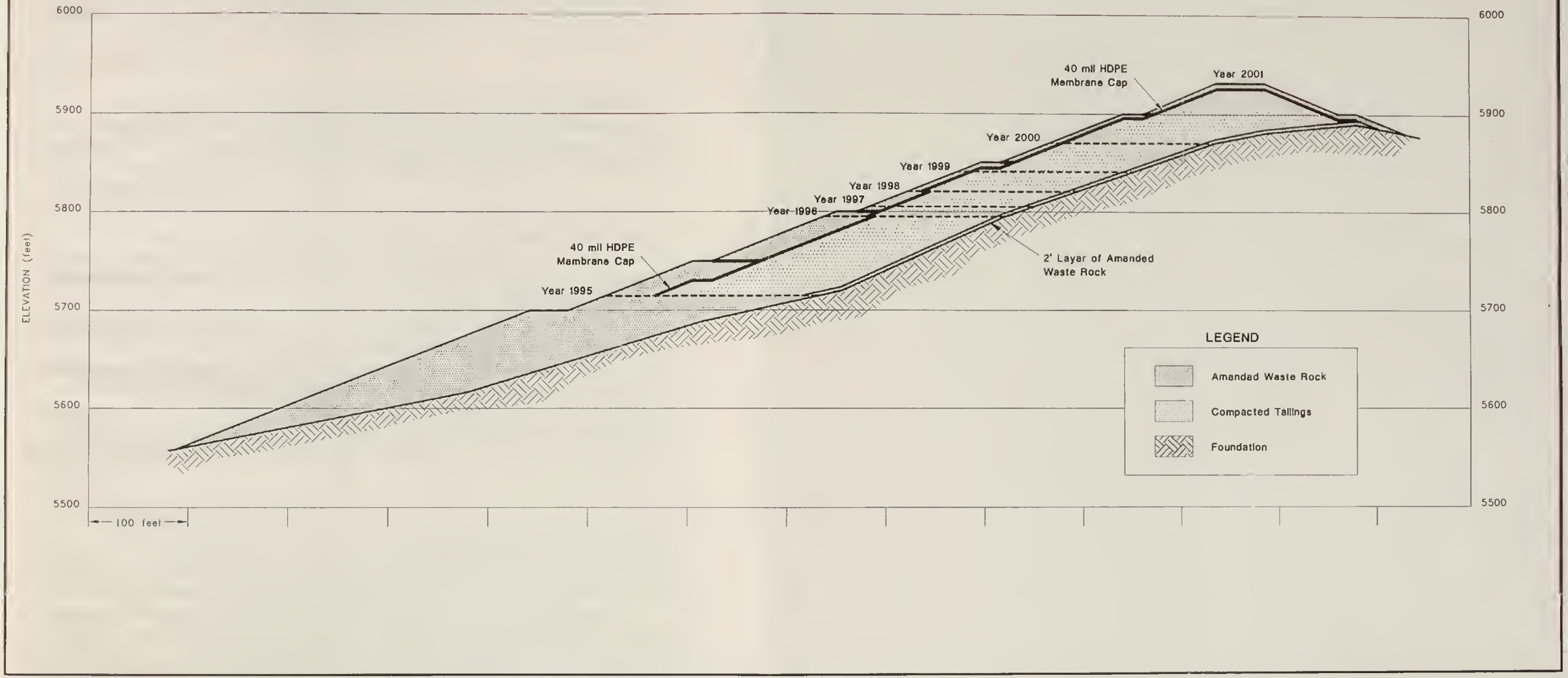

Waste Rock and Tailings Repository
Composite Section
Diamond Hill Mine Project
Broadwater County, Montana
FIGURE 4-1

HYDROLOGY

Weathering of sulfides would occur. The company has proposed a plan to limit the amount of water that can come in contact with and leach through reactive rock and tailings deposited on the surface in the waste rock/tailings repository. Evaluations of the plan were conducted through use of the HELP model (Pegasus Gold Corp. 1995a, Appendix C).

No-Action Alternative

Under the no-action alternative, the exploration decline would be allowed to flood once exploration activities have ceased. Under this alternative, only impacts from the existing and historic facilities (exploration adit and associated waste rock repository, plus historic adits and dumps) would occur. These potential impacts are described in the two EAs regarding the exploration decline proposal (DSL 1994a and b).

Void spaces created by underground exploration tend to interconnect previously isolated fractures and faults. Prior to exploration, some of these structures would have been conduits for groundwater, while others would not have been connected to sources of recharge and would therefore have been dry. Underground exploration can drain fractures, possibly resulting in loss of flow at pre-existing springs, and can also re-direct water into previously dry fractures, resulting in the formation of new springs. The locations of underground fractures and their relationships to surface features such as springs are frequently impossible to determine prior to mine development. Therefore, effects on springs and seeps cannot be precisely predicted. One spring exists within Portal Gulch but is located within the alluvial bottom of the drainage. Therefore its source of water is likely from near-surface groundwater flows rather than discharge from deeper bedrock fractures. Development of the exploration decline has not resulted in loss of flow at this spring to date, and is not predicted to do so in the future.

Because underground exploration tends to intersect many bedrock fractures, large quantities of water can flow into underground operations. If an adit is driven horizontally or at an incline into an ore deposit, water from intercepted fractures would discharge to the surface via the adit. Declines such as that at Diamond Hill may also discharge if inflows are great enough. Alternately, the level of mine flooding may stabilize at some elevation lower than the portal of a decline if inflows are balanced by outflows through other fractures at lower depths. The bedrock surrounding the Diamond Hill deposit has a low fracture density, and rates of inflow to date have been slight. Due to the low permeability of the surrounding bedrock and the small recharge area up-gradient of the mine, the exploration decline is not predicted to flood to the extent that water would discharge from the Marquis Portal. This conclusion is consistent with the condition of the historic adits on Diamond Hill, which also do not discharge water.

Seeps are not predicted to form below the existing waste rock repository because evapotranspiration from the revegetated cover soil and the geosynthetic liner beneath the cap would prevent water from infiltrating into the underlying waste rock. Seeps are not observed below the historic waste rock piles at Diamond Hill despite the fact that these rock piles are neither reclaimed with soil nor vegetated. This lack of seepage is related to the relatively arid conditions at the site.

The existing make-up water well is located in Portal Gulch, which is an intermittent/ ephemeral stream contributing little to the flows within Indian Creek. To date, use of this well has not resulted in noticeable changes in flow of Portal Gulch.

As the water table within the mine reaches equilibrium, inflows to the mine would be balanced by outflows via fractures. Similar conditions should currently exist with the historic adits at Diamond Hill, but no resultant impacts to groundwater or surface water quality have been observed. To date, the quality of water flowing into the exploration decline has been good (Pegasus Gold Corp. 1995a). If the post-closure quality remains similar, no impacts to adjacent waters would be predicted. If not, it is still unlikely that impacts to surface water could be detected due to the low predicted seepage rates (equivalent to current exploration inflow rates of less than 15 gpm).

Impacts to water quality under the no-action alternative would be short-term and restricted to effects of stormwater discharge from the site which would carry increased loads of suspended sediment until the disturbances have become successfully revegetated. Stormwater is currently routed to settling and infiltration ponds which prevent the release of this sediment-laden water to surface waters.

Proposed and Mitigated Projects

Phase I. Hydrologic impacts to the Diamond Hill site resulting from Phase I of the project (50,000 ton test-milling of ore off-site) would be no different than the impacts under the no-action alternative, with the exception that any existing impacts related to stormwater would be prolonged for about an additional year.

Phase II. The major hydrologic change at the site during Phase II would involve expansion of the area of underground workings, which would likely result in increased inflows into the mine. The additional water would be disposed over an enlarged LAD area. Stormwater would be disposed via infiltration galleries. If land application is properly managed and stormwater controls are adequate, impacts to water quality from the project will be minimal. Large storm events or adverse weather conditions could result in the discharge of infiltrated stormwater to surface waters. Stormwater sampled at the site has not been acidic, and therefore does not contain dissolved metals which could potentially cause water quality degradation. Metals contained within the suspended

sediment in the stormwater would settle in the infiltration galleries and would not likely discharge to surface waters.

Underground mining is not anticipated to influence flows in Indian Creek or the West Fork of Indian Creek. The bedrock of Diamond Hill is of very low permeability, as indicated by the low inflow rates to the existing exploration decline and historic adits. In addition, mining would not occur beneath Indian Creek or the West Fork of Indian Creek. For these reasons, no impacts to surface water quantity due to mine inflows are predicted.

Phase III. Under Phase III, a mill would be constructed on-site. Tailings would be deposited within the waste rock/tailings repository and underground. A large stormwater reservoir would also be constructed. Capture of stormwater from the mine site within the stormwater reservoir would reduce flows in Portal Gulch during major storm events but would have no long-term effect on base flows.

Concurrent reclamation and capping of the dried tailings with a synthetic liner would result in a low probability of significant quantities of precipitation and stormwater penetrating the waste rock/tailings depository. Furthermore, the facility would be located within a dry gulch and would therefore not be susceptible to saturation by groundwater or surface water.

Mine inflows would be similar to those under Phase II.

Waste rock segregation within the waste rock/tailings repository, in conjunction with the proposed capping and reclamation of the facility, would make the development of contaminated seepage unlikely. If water were to infiltrate through the waste rock/tailings repository or penetrate it from beneath, this water would be conveyed through the limestone underdrains beneath the waste rock/tailings repository which would neutralize any acidic water. This water would then be captured in the pond below the facility.

Water samples collected from the exploration decline have had a neutral to slightly alkaline pH and low metals content. If the quality of water in the underground workings were to remain similar during the production and post-closure phases, then discharge of this water would not present any problems once nutrient (nitrate and ammonia from blasting agents) concentrations subsided. Regardless, the bedrock of Diamond Hill is of very low permeability, as demonstrated by the very low inflows observed to date within the exploration adit, as well as the lack of discharges from the historic adits on the property. The proposed workings are mostly below the elevation of the mine portal. For a discharge to occur, all of the workings would first have to flood to the elevation of the existing Marquis Portal. Observation of existing underground workings at the site indicates that this is not probable. Some of the historic workings may drain via fractures within the hill, but baseline

water quality data for adjacent streams do not indicate impacts. Continued monitoring of flows and water chemistry during and after the proposed mining operation would identify any water quality impacts if they should occur, allowing for remediation.

It has been proposed that land application be conducted at rates which will not saturate the soil or result in overland flow. If the system is properly operated and monitored, these measures should prevent groundwater or surface water contamination resulting from LAD. During the exploration phase, land-applied water has consisted of mixed underground mine water and stormwater. Analysis of this water has shown it to be alkaline and to have low concentrations of dissolved metals. Assuming stormwater chemistry during operations would be similar, no impacts are anticipated. This would be verified by monitoring of water chemistry.

The proposed mine is designed such that all stormwater runoff would report to a lined capture pond. Contaminated sediment would not be transported off-site by runoff. The pond would not be removed nor bond released until the site had become stabilized with vegetation, preventing post-mining impacts from erosion and sediment transport.

Pegasus has proposed a water resources monitoring program designed to adequately detect long-term changes in surface and groundwater quality.

SOILS AND RECLAMATION

Soils in the area are characteristic of soils in other foothill to mountainous regions of southwestern Montana. Salvageable soils in the project area at Diamond Hill are limited in depth by steep slopes and rock content. The mining company has proposed supplying additional soil from an alluvial borrow source in the Indian Creek drainage. This soil meets the salvageability criteria DEQ. Vegetation volunteering on the borrow source and growing on areas reclaimed by Pegasus during the exploration phase of the project indicates the potential for its use as growth medium.

The proposed replacement of 18 inches of replacement growth medium on mine-related disturbances would approximate the majority of the premine soil depths surveyed on the site during baseline resource studies. The agency has concluded that the proposed soil salvage and replacement plan under any alternative would provide the comparable stability and utility needed in the reclaimed landscape. As a result, soil impacts will not be tracked through the analysis chapter.

RANGE AND VEGETATION

Plant communities in the Diamond Hill area are characteristic of other foothill and mountain plant communities in southwestern Montana. Reclamation seedings at Diamond Hill conducted by

Pegasus during the exploration phase indicate the potential success of the proposed revegetation plan. Reclamation areas on other hardrock mines in southwestern Montana typically take 3-5 years to fully develop to comparable production and cover values of herbaceous vegetation. The number of species and productivity of woody vegetation would take a much longer time to recover, especially in the Diamond Hill area which is in a rain shadow of the Elkhorn Mountains.

DEQ has concluded that although the number of species and productivity of tree and shrub species would be limited for a long time, the reclamation plan would produce comparable stability and utility of vegetation cover and productivity for seasonal elk or livestock forage. This would meet the projected post-mine land use requirements. Noxious weed control will be necessary to limit spotted knapweed and eventually diffuse knapweed and dalmation toadflax spread on the disturbed areas. Pegasus has an approved noxious weed control plan with Broadwater County for the property.

With comparable levels of productivity and cover, potential evapotranspiration would be adequate to limit potential acid seepage as predicted under the water resources section. Vegetation and range impacts would be the same for all alternatives, and as a result, will not be tracked through the analysis chapter of the EIS.

WILDLIFE AND FISHERIES

The small size of the project limits the effects on the wildlife species habitat. As discussed in Chapter 1, wildlife issues were raised and dismissed by the agency interdisciplinary team during the public scoping and agency completeness review of the application.

DEQ has concluded (in the water resources section) that the potential for contaminated seepage and resultant impacts to off-site aquatics and fishery resources is remote, regardless of the alternative. The small size and short duration of the proposed project would minimize any impacts to wildlife, including the proposed reintroduced bighorn sheep. As a result, wildlife and fishery impacts will not be tracked through this analysis chapter.

LAND USE AND RECREATION

The Diamond Hill area has a long history of mining, wildlife exploitation from hunting, logging, livestock grazing and diverse recreational activities, including four wheeling and mountain biking, rock climbing, wildlife watching, hiking, and scenic automobile tours through the mountains. The proposed mine activity is consistent with historic land use in the area.

The proposed reclamation plan would return the site to similar topographic conditions and comparable productivity and cover of plant communities that would support wildlife and livestock

grazing. As discussed in Chapter 1 (Issues That Will Not Receive Further Consideration), recreational conflicts produced by the increased traffic during mine life would be mitigated by company proposed mitigations as well as traffic safety mitigations DEQ developed and discuss in the transportation section of the EIS.

As a result, the agency has concluded there are no land use impacts from any of the alternatives, and land use will not be carried through further analysis.

TRANSPORTATION

Access to the Diamond Hill project has been via existing county roads. Primary access has been the Indian Creek Road, which is operated and maintained by Broadwater County, from its intersection with Montana Highways 287/12 near Townsend, Montana. The existing conditions in Indian Creek Canyon were risky, even before the exploration program began, especially during hunting season and/or when logging was being conducted in the Elkhorn Mountains. The county road passes through Indian Creek Canyon, resulting in a narrow winding section of road approximately one mile long with limited turnout possibility and reduced line-of-sight.

No-Action Alternative

Under the no-action alternative the existing traffic on the Indian Creek Road would essentially remain the same as long as exploration continued, lime was hauled from Continental Lime and alluvial borrow was hauled from the Indian Creek area adjacent to the permit area for concurrent reclamation. Less traffic would be generated during final reclamation of the exploration disturbance.

No traffic accidents were reported from the exploration program. Approximately 25 employees used Indian Creek Road for about 12 months during the development of the exploration decline. The exploration development did overlap with the 1994 hunting season peak traffic during which an additional 2-3 trucks per day transported material along Indian Creek Road without incident (Pegasus Gold Corp. 1995e).

Proposed Project

Under this alternative, the proposed Diamond Hill project would be developed. The Indian Creek Road would continue as the primary access for the project. Secondary access would be provided via the Radersburg Road from Toston, to Crow Creek Road, then to Mud Springs Road, which joins the Indian Creek Road two miles south of the project.

Material such as lime rock, construction materials, and chemical milling reagents, if the Phase III mill is constructed on-site, would be hauled to the Diamond Hill site via the Indian Creek Road. A pilot car with radio contact will be utilized to minimize conflicts with public road use. Flagmen would be used if hauling alluvial soil materials across the county road created a road hazard. Pegasus would publish in the local newspaper any activities that would cause significant disruption of public use of the road. The mine projects' busing and employee transportation program would provide additional public safety.

Risk of accidents would increase with mine development and the Phase III development of a mill on-site as a total of up to 69 employees would be working at the mine and mill. Fewer employees would be required at the project site during phases I and II with trucking of ore. Supply trucks, some carrying reagents, would also increase the risk of an accident on the road. Pegasus is proposing to truck ore for up to 6 years to Montana Tunnels in convoys of three or more trucks via the Indian Creek Road to Montana Highways 287/12. The 35-ton highway haul trucks would travel to Helena and take Interstate 15 to Jefferson City, where they would exit and travel to Montana Tunnels on the Corbin-Wickes Road.

There would be 20 trucks per day transporting ore during Phase I, and 40 trucks per day during Phase II which would increase the ADT by 40 to 80 vehicles, respectively. Employee and supply truck traffic is estimated to be 10 to 20 vehicles per day (5 to 10 round trips). The mine-related truck traffic during Phase II would be more than five times the average amount of traffic on Indian Creek Road during hunting season (mid-October to December), while increasing overall average traffic by more than 420 to 700 percent during Phases I to II respectively. Although there are no accident data for Indian Creek Road, this increase in traffic could increase the chance for accidents involving the public and mine-related traffic during Phases I and II, and the risk would be greatest during hunting season. Under Phase III, there would not be any hauling of ore off the permit area; thus, under Phase III, traffic increases would be limited to employee buses and vehicles (estimate fewer than 10 vehicles per day), supply trucks, and concentrate/dore' haulage traffic (about 3 trucks per week). Phase III traffic probably would not exceed that generated during Phase I.

Pegasus has committed to studying the potential use of a traffic light system in the canyon that would automatically warn travelers if a car is in the canyon at the time and create alternating one-way traffic in the canyon. According to MDOT, this is not the most desirable solution because it is unmanned and the public could ignore the signal and enter the canyon when they should not. Failure of the system would not be detected until someone inspecting it realized it was not functioning properly. A signal system manually triggered by flagmen in conjunction with pilot cars as proposed would have a smaller risk of failure or misuse.

The use of pilot cars for convoys would probably mitigate but not eliminate the increased risk of accidents within the canyon. However, the use of pilot cars through the canyon does not mitigate accident risks resulting from 2-lane traffic on the narrow (14- to 24-feet wide) upper stretches of road above the canyon. This could be mitigated by using pilot cars and flagman for the portion of the haul route between the mine to the lower end of Indian Creek Canyon.

Congestion would be increased at the intersection of Indian Creek Road and Montana Highways 287/12 during traffic delays caused by passing trains. However, most of the mine-related traffic would be turning either west off Indian Creek Road or onto Indian Creek Road from east-bound highway traffic. There would be increased use of the west highway shoulder by traffic waiting to turn. There would be a slight increase in west-bound traffic turning across the highway, as some supply trucks, employee buses, and company vehicles would be coming primarily from Townsend. The impact of the increased traffic on the existing congestion at this intersection cannot be quantified, but it could slightly increase due to turning or waiting vehicles.

Mitigated Project

Traffic safety is a significant issue in the Indian Creek area. DEQ would stipulate that Pegasus work with Broadwater County and possibly BLM to develop alternative ore hauling traffic routes away from the Indian Creek canyon and allow for safe passage of public traffic and mine vehicles on Indian Creek Road between the canyon and the proposed project. Pegasus would also be required to use flagmen and pilot cars the entire stretch of Indian Creek Road between the mine and the lower end of Indian Creek Canyon, if alternate routes could not be developed.

Potential mitigations could include rerouting ore hauling traffic onto other county roads such as the Radersburg Road, or a private road, such as the Black Diamond Mine Road, and widening Indian Creek Road above the canyon to incorporate at least pullouts. Implementation of any of these mitigation would further reduce potential accidents. While none of these mitigations would reduce the amount of traffic, the risk of vehicle accidents involving mine traffic and the public would be greatly reduced. The magnitude of traffic safety impacts is difficult to determine at this time with the data available. Only widening the upper portion of the road would improve traffic safety in the long-term because these improvements would remain in place after mine closure.

Hauling ore down to Radersburg, to Toston, and then north to Townsend would add approximately 30 miles one-way to each trip to or from the mill at Montana Tunnels. This would in turn increase the amount of diesel fuel used for the haul trucks, the amount of required vehicle maintenance, and the haulage time. Pegasus would also need to do some improvements along this route to accommodate the ore hauling trucks.

Using the Black Diamond Mine Road could potentially affect Continental Lime's air monitoring program as the road passes close to a monitoring station. A dust suppression program, such as oiling the surface, could help minimize that impact. Barricading the road would help control unauthorized public use, and reclaiming the road after mine closure would help reduce road density in that portion of the ECMA. Only a portion of this road is accessible because the upper portion has been cut off by the mine's highwall. An alternate route would need to be constructed to get around the mine (Pegasus Gold Corp. 1996). The extensive amount of construction needed to upgrade this road could lead to increased amounts of seldom reaching surface waters. The use of BMPs would help limit the amount of sediment.

AESTHETICS

Long-term visual impacts from topographic changes and land disturbance at Diamond Hill would be minimal under all alternatives (see Geology, Soils, and Range and Vegetation). As a result, visual impacts will not be discussed any further in this EIS.

Impacts from the operation of equipment and the potential on-site mill would elevate noise and light levels above typical forest noise levels. Noise levels under the action alternatives could be slightly higher and continue for a longer period than under the no-action alternative. However, Diamond Hill is located close to a fairly heavily travelled road and about 5 miles from Continental Lime's active mine and kiln. The slight increase and short duration of noise and light generated by any alternative would have minimal impacts. As a result, noise and light impacts will not be discussed any further in this EIS.

SOCIOECONOMIC CONDITIONS

No-Action Alternative

Under the no-action alternative, exploration would probably continue for less than a year before Pegasus decided to either cease operations and reclaim the site or to resubmit a new permit application. This would provide the county and city governments with a minor amount in continued tax input (Pegasus Gold Corp. 1995d). If Pegasus decided to close the operation, there would be a loss of 25 positions. Some of these workers would probably go elsewhere seeking mining-related employment. Others might seek retraining in other fields or take lower-paying jobs in other employment sectors. In addition to the minor loss of direct tax generated by exploration, there would also be a decrease in both direct and indirect income and personal property taxes.

There would not be a sizeable change in the demand for housing and government services. Any exploration-related change would be offset by the increasing popularity of Townsend as a

retirement community and commuter community for Helena workers. With or without continued exploration, it is very likely that the Broadwater School District would request a new mill levy to expand the existing school facilities or build a second school to handle the rising number of school age children (Jim Hone, County Commissioner, personal communication with Kathleen Johnson, October 17, 1995).

Proposed and Mitigated Projects

Under either action alternative, it is estimated that the Diamond Hill Mine Project would generate between approximately $1.2 and $2.0 million in taxes over 6 to 7 years (Pegasus Gold Corp. 1995d). The employment of up to 69 workers and indirect increases in services and retail sectors would generate additional income and property taxes during that time.

If all the ore was mined and processed as described for Phase II, the capital investment at the mine site would be lower than it would be under Phase III. This would reduce the ad valorem property taxes collected by Broadwater County but would slightly increases taxes associated with a new crusher unit at Montana Tunnels to Jefferson County. Under Phase II, the total estimated taxes paid over a minimum 6-year period would be $1,164,134, of which $956,706 would go to Broadwater County and $207,428 would go to Jefferson County (Pegasus Gold Corp. 1995d).

Mining and milling the ore primarily at Diamond Hill as described under Phase III would confine estimated legal tax payments exclusively to Broadwater County. The construction of the mill would increase ad valorem property tax by approximately $1 million. Under Phase III, the estimated total local taxes would be $1,978,597.

If Pegasus achieves an 80 percent local hiring, only about 14 new workers and their families would immigrate into the Townsend area. If all new workers settled in or around Townsend, there may be a shortage of available housing. Given the short duration of the project, some workers may decide not to purchase a house and either find rental units or mobile homes. There are no anticipated impacts to water or sewer system requirements or users. The cumulative increase in population might place some additional strain on law enforcement, emergency response, and social services, but the increases are not likely to be very great. Since the school system is already at capacity, any additional students, in conjunction with those associated with the generally increasing population, could force the school system to find additional space for more classes or expand the size of the classrooms until a new facility could be built with anticipated new mill levy funds.

Although the proposed project does not employ enough staff (75 or more workers) to trigger the Hard Rock Impact Act, Pegasus has committed itself to working with the city and county governments to develop a plan to mitigate any fiscal impacts the project might generate (John

Fitzpatrick, Pegasus Gold Corp., personal communication, April 7, 1995). This voluntary plan could help cover possible costs associated with slight increases in law enforcement and emergency response services, increased demands on school resources, and possible increased needs for social services. Since this plan has not yet been developed, the effect this voluntary mitigation would have on reducing the minor fiscal impacts cannot be quantified.

CULTURAL RESOURCES

All alternatives include either underground exploration or an underground mine which minimizes surface disturbance under all alternatives and would be a continuation of the mining process historically employed in the district. Past mining and prospecting activities have disturbed some of the surface features of the district. DEQ has consulted with SHPO (SHPO 1995) and has determined that because the major eligible historic structures, such as the stamp mill, would be avoided, there would be no significant affect on the historic integrity of the district. Some small tailings piles and prospect pits would be removed but they add little in the way of important historic information. Because the Diamond Hill Mine Project would be located entirely on private land with no federal agency involvement, Section 106 consultation is not required. For these reasons, cultural resource impacts will not be discussed any further in this EIS.

UNAVOIDABLE IMPACTS

Unavoidable impact are impacts that could not be avoided regardless of mitigations that might be implemented.

Geology and Topography

Ore would be mined and processed leaving open areas underground to refill with water. While this ore would be depleted, the refined gold and silver extracted from the concentrate and dore' could be recycled indefinitely. The construction and reclamation of the waste rock repository or waste rock/tailings repository would change the topography to a lesser or greater degree respectively within the repository footprint.

Hydrology

Mining and construction activities could alter water quality and quantity. The proposed water management plans would limit the changes.

Transportation

The risk of an accident to users of the Indian Creek Road would increase as the volume of mine-related traffic (supply trucks, employee busing/vehicles, ore trucks, and concentrate and dore' trucks) increases with mine development. Mitigations proposed would reduce but not eliminate the increased risk. Congestion at the intersection of Indian Creek Road and Montana Highways 287/12 would increase slightly, especially during train-related traffic delays.

Socioeconomic Conditions

The development of the Diamond Hill Mine Project would provide another major employer but could add to the burdens of various government services already dealing with a growing population. The amount of taxes, both direct and indirect, would increase during the life of the project.

SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

The term *"short-term"* refers to the near future; in the case of the Diamond Hill Mine Project, it refers to the 7-year life of the project. The term *"long-term"* refers to uses that extend or would continue 10 years or more into the future. This section looks at the trade-offs between what would be gained in the short-term from developing the proposed project and what long-term uses or productive values would be lost.

Geology and Topography

The short-term use would be to mine ore-grade material according to the proposed project. This would have no affect on long-term productivity. Additional ore could be mined if additional reserves were discovered or if gold and/or silver prices would make mining and processing lower-grade ore profitable. Loss of potential long-term productivity of surface resources affected by the development of a waste rock repository or the waste rock/tailings repository would be restored when reclamation was completed.

Hydrology

During the project, water collected underground and in surface ponds would be used for drilling, dust control and, for milling, if Phase III is implemented. It is anticipated that most or all of the water used would be obtained from captured stormwater and mine inflows. Potable water would be obtained from a well. No effects on long-term uses or productive values are anticipated.

Transportation

Short-term increases in traffic volumes would end when mine operations ceased and the site was reclaimed. Under the mitigated project, depending upon the mitigations worked out with Broadwater County and BLM, the long-term use of Indian Creek Road might be improved or could remain unchanged. The use of pilot cars and flagmen, the use of a temporary traffic light control system, or the temporary use of the Black Diamond Mine Road for ore traffic would have no long-term effect on the current accident risks in Indian Creek Canyon. Widening upper portions of the road or the development of pullouts would increase long-term traffic safety in that stretch of road.

Socioeconomic Conditions

Broadwater County and the City of Townsend (and Jefferson County under Phase II operation) would benefit from increased tax revenues during the 7 years of operation. The revenues generated directly from the mine would end when the mine ceased operations and was reclaimed. Property and income tax revenues from workers and indirectly from the services sector would gradually decrease as workers moved elsewhere for employment, unless new employment was obtained locally, allowing mine workers to remain in the area. Persons with fixed incomes would be affected to a greater degree than working people as land and housing values increased in the short- and long-terms.

The influx of new mine employees and their families could add to the growing burden on government services, especially the school system. The development of a plan between the local government agencies and Pegasus, similar to that required by the Hard Rock Impact Act for larger operations, would help mitigate the financial burdens of providing increased services. That assistance, however, would not continue beyond the closure and reclamation of the mine. The county, city, and school district would need to rely on the expanding local tax base to pay for services needed by a growing population.

IRREVERSIBLE AND IRRETRIEVABLE LOSSES

An irreversible or irretrievable commitment of resources would occur when resources were either consumed, committed, or lost as a result of the project. The commitment of a resource would be *"irreversible"* if the project started a "process" (chemical, biological, and/or physical) that could not be stopped. As a result the resource, or its productivity and/or its utility would be consumed, committed, or lost forever. Commitment of a resource would be considered *"irretrievable"* when the project would directly eliminate the resource, its productivity, and/or its utility for the life of the project.

Geology and Topography

Up to 2,890,000 tons of ore and waste rock would be removed from underground workings during development of either the proposed or mitigated project. However, since gold and silver do not degrade, they could be recycled or reused indefinitely. Although some of the tailings and waste rock might be returned to underground workings, the removal of the ore would be irreversible and irretrievable. Leaving portions of the underground workings open would expose sulfides to air and water which could accelerate existing rates of weathering, potentially generating acid over the long-term. Flooding of the mine workings would reduce that potential.

Hydrology

Under Phase III, stormwater would be captured and used by the mine and mill. This would represent an irretrievable reduction in peak stream flows during runoff events. Phases I and II capture smaller portions of stormwater which would be channelled primarily into infiltration galleries. This would have a smaller impact on reducing peak stream flows. Mining beneath Diamond Hill would irreversibly modify bedrock hydrogeology and could modify water quality in the mine workings.

Transportation

Traffic on Indian Creek Road would be irretrievably increased during the life of the project. The magnitude of the traffic increase and associated accident risks would depend upon the mitigations developed between Pegasus, Broadwater County, and BLM. Any permanent changes such as widening or developing pullouts along the upper portion of the road would irreversibly decrease the risk of accidents along the changed portions of Indian Creek Road.

Socioeconomic Conditions

Tax revenues would irretrievably increase during the life of the mine. This would enable the county, city, and school district to keep pace with the demands placed on government services due to both the general population growth in the area and any mine-related influx of workers. The mine development could irreversibly or irretrievably stimulate private sector economy. The permanency of new companies and services would depend upon the continued needs and demands of the general population. After mine closure, tax revenues would probably return to close to existing revenue levels.

CUMULATIVE IMPACTS

Cumulative impacts are defined as collective impacts for the project when considered in conjunction with other past, present, and reasonably foreseeable activities. (These activities are described in Chapter 2.) Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Geology and Topography

Since the proposed volume of new tailings from milling Diamond Hill Mine ore would be less than 2 percent of the total volume permitted at Montana Tunnels, no redesign of that tailings impoundment would be needed.

Hydrology

Road construction/reconstruction and possibly reclamation could contribute sediment to Indian Creek. This sediment, along with sediment generated by placer mines in the drainage and Continental Lime's operations, could cumulatively affect water quality in Indian Creek during the short term.

Transportation

The amount of traffic on Indian Creek Road will cumulatively increase with mine-related traffic, general increases in recreational and hunting traffic due to the general population growth in the area, and potential increases in hunting due to the approved relocation of big horn sheep into the Elkhorn Mountains and the improvement in big game habitat due to vegetation treatments by the Forest Service and BLM. Traffic would increase about 500 percent during implementation of Phase II. Increased traffic would increase the risk of accidents as well, especially during hunting season.

The magnitude of the cumulative traffic increase and associated accident risks would depend upon the mitigations developed between Pegasus, Broadwater County, and BLM. Using the Black Diamond Mine Road as a temporary haul road could potentially disturb reintroduced bighorn sheep as the road would go along the far eastern edge of the proposed Indian Creek winter range. However, it is not anticipated that use of this road would significantly effect the success of the reintroduction as FWP's proposed winter restriction on the road to the Iron Mask Mine about one-half mile west of the Black Diamond Mine Road is not considered to be essential to the success of that project (USDA, 1995).

The construction of the power line would temporarily increase traffic on Indian Creek Road. The use of the power line, however, would eliminate the need for generators and their diesel fuel

tanks. This would in turn reduce the amount of fuel transported to the proposed project and reduce the risk of accident-related fuel spills along Indian Creek Road during mine operation.

Socioeconomic Conditions

Area population is projected to continue increasing as people move into the area seeking cheaper housing, a better way of life, and new jobs. The development of the Diamond Hill Mine Project would cumulatively add to the population growth and demand on and for government services, especially the school system.

EVALUATION OF RESTRICTIONS ON PRIVATE PROPERTY

In Chapter 545, Laws of 1995 (SB231), the Legislature amended MEPA to require agencies to evaluate in their MEPA documents any regulatory restrictions proposed to be imposed on the use of private property.

Pegasus' mitigations addressed some but not all the traffic safety concerns that could be generated by a 400 percent increase in traffic. The mitigated project differs from Pegasus' proposed project in that one permit condition would be required to address the issue of traffic safety. This permit condition would require that Pegasus work with Broadwater County, BLM, and possibly Continental Lime to improve traffic safety on the road between the lower end of the canyon and the project access road. This could be addressed in any of three ways: improving Indian Creek Road; upgrading the Black Diamond Mine Road for a short-term ore hauling road, or hauling ore via Radarsburg. Any changes or improvements to Indian Creek Road would have to be approved by Broadwater County. Pegasus might need to obtain approval by the county and/or BLM to temporarily develop or upgrade alternative roads such as the Black Diamond Mine Road. These traffic safety mitigations would not prohibit the development of the Diamond Hill Mine Project as proposed by Pegasus, but Pegasus would be required to spend additional funds to implement them.

Pegasus has discussed cost estimates for improvements to Indian Creek Road with Broadwater County officials. The work would include improving line-of-sight on two or three curves, removal of some vegetation within the county right-of-way, and construction of two pullouts at an estimated cost of $100,000 (Pegasus Gold Corp. 1996).

Preliminary estimates for upgrading the Black Diamond Mine Road ranged between $400,000 and $500,000 (Pegasus Gold Corp. 1996). The lower portion of the road provides access to the mine's pit, but the upper portion has been cut off by the mine's highwall. Constructing a suitable alternate access route for Diamond Hill's ore trucks would result in significant amounts of surface

disturbance. Portions of this route are owned by Continental Lime, and Pegasus has no agreement permitting construction and use of this route.

If Pegasus were required to haul ore on the Radersburg Road, then the additional driving distance required by this mitigation would increase the ore truck maintenance costs; increase haulage time, costs, and fuel consumption; and increase employee driving time. Pegasus estimates that use of this route would increase haulage costs by 50 percent, in part because the company would need to hire one additional truck and driver to allow for continuous loading of ore (Connie Cole, Pegasus Gold Corp., personal communication with Kathleen Johnson, DEQ, January 21, 1996). In addition to the increased haulage expenses, improvement costs along this route would be approximately $200,000 (Pegasus Gold Corp. 1996).

No mitigation is available that would eliminate either the existing risk or the increased risk that would result from Pegasus' increased use of the Indian Creek Road. Because Pegasus has proposed some traffic safety mitigations in its proposed plan, risk would not increase significantly with increased use. Therefore each of the potential mitigations described above is more burdensome than the mitigations proposed by Pegasus.

No agency mitigations were proposed to deal with the issue of county economics. Pegasus has proposed working with the county to develop a tax payment plan similar to that required by the Hard Rock Impact Act for larger mines. It was felt that Pegasus' mitigation was sufficient to address this issue and no changes were proposed by DEQ.

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CHAPTER 5 - CONSULTATION WITH OTHERS

Agencies, companies, and organizations consulted include the following:

Broadwater County
Broadwater County Ambulance Service
Broadwater Rod and Gun Club
Montana Department of Fish, Wildlife, and Parks
Montana Department of Transportation
Montana State Historic Preservation Office
Pegasus Gold Corporation
USDA Forest Service, Helena National Forest
U.S.D.I. Bureau of Land Management

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CHAPTER 6 - PREPARERS

The following people from Montana Department of Environmental Quality were involved in the research, writing, and internal review of this draft EIS:

Name	Project Responsibility	Education
Kathleen Johnson	Project Coordinator, Transportation, Socioeconomics	B.S., Landscape Architecture, Cornell University; M.S., Land Rehabilitation, Montana State University
Pat Driscoll	Air Quality	B.S., Environmental Engineering, Montana College of Mineral Science and Technology
Wayne Jepson	Hydrology	A.B., Earth Sciences, Dartmouth College; B.S., Geology, University of Montana
Peter Werner	Geotechnical Engineering	B.S., Civil Engineering, Montana State University; B.S., Geology, Stanford University; M.S., Mining Engineering, Columbia University
Patrick Plantenberg	Soils, Vegetation, Wildlife, Recreation, Aesthetics	B.S., Agricultural Science, Montana State University; M.S., Range Science/Reclamation, Montana State University
Sandi Olsen	Reviewer	B.A., Biology, Mount Holyoke College
Bob Winegar	Reviewer	B.S., Geology, University of Missouri at Kansas City; M.S., Geology, University of Montana
Rebecca Miller	Geochemistry, Geology	B.A., Geology, Western State College of Colorado; M.S., Geology, University of Texas
Joe Gurrieri	Hydrology, Cultural Resources	B.A., Geography, Central Connecticut State University; M.S., Geology, University of Connecticut
Fran O'Hara	Word Processing	Indiana University and Helena College of Technology of the University of Montana

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CHAPTER 7 - DISTRIBUTION AND REVIEW OF THE EIS

Copies of this draft EIS are being provided to about 54 persons, groups, local governments, and agencies that have expressed an interest in the Diamond Hill Project. The mailing list was compiled using the names and addresses of:

- parties who participated in the public meeting or submitted written comments;
- parties who have requested copies of the draft EIS;
- agencies, governments, and companies potentially affected by the proposed operation; and
- agencies, and groups consulted during draft EIS preparation.

The following agencies, organization, and individuals received a copy of the draft EIS:

Federal, State, and Local Agencies

Broadwater County ASCS Office
Broadwater County Commissioners
Broadwater County Library
Environmental Quality Council
Environmental Protection Agency
Jefferson County Commissioners
Jefferson County Library
Lewis and Clark County Library
Montana Department of Commerce
Montana Department of Environmental Quality
Montana Department of Fish, Wildlife and Parks
Montana Department of Natural Resources and Conservation
Montana Department of Transportation
Montana Environmental Quality Council
Montana State Historic Preservation Office
Montana State Library
Montana Tech Library
Office of the Governor
USDA Forest Service, Helena National Forest
USDI Bureau of Land Management

Federal and State Officials

Montana Representative Duane Grimes
Montana Senator Mike Foster
United States Representative Pat Williams
United States Senator Conrad Burns
United States Senator Max Baucus

Individuals and Organizations

Bean, Christine
Bomar, Boyd and Roberta
Boster, Geraldine
Burke, Ron
Casey, W.
Charney, Elton
Collins, Alan
Dengel, Dan
Echo Bay Exploration, Peter Mejstrich
Fidelity West Group Ltd., D. Stambaugh
Jepson, John
Koehnke, Francis
Koehnke, Mike
LaLacheur, Eric
LCM Limited, Amy Davis Martin
McCurly, Earl
MEIC, Jim Jenson
National Wildlife Federation, Tom France
NPRC
Pegasus Gold Corporation
Price, Hal and Olive
Sautter, Ben
Shaw, Chris
Stevenson, Yvonne
Stombaugh, Daryl
Stoner, John L.
Tyrrel, Nila
Wright, Alan

CHAPTER 8 - GLOSSARY, ABBREVIATIONS, AND ACRONYMS

acid-base account	A laboratory method to determine the acid-generating potential of potential sulfur minerals.
andesite	A dark-colored, fine-grained extrusive rock that, when porphyritic, contains larger crystals (phenocrysts) composed primarily of zoned sodic plagioclase and one or more of the mafic minerals with a groundmass composed generally of the same minerals as the phenocrysts. It is the extrusive equivalent of diorite, an intrusive igneous rock type.
ADT	average daily traffic
AQD	Air Quality Division, Department of Environmental Quality
ARM	Administrative Rules of Montana
BACT	Best Available Control Technology
BLM	Bureau of Land Management
BMP	Best Management Practice
bulking	Expansion of material due to rock fracturing from blasting, grinding and processing
CECRA	Comprehensive Environmental Cleanup and Responsibility Act
CERCLA	Comprehensive Environmental Response, Compensation, and Recovery Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
cy/me	cubic yards per meter
concentration	Amount of material contained in a specified volume, or the strength of a solution (mass per volume).

degradation	The increase in concentration of certain regulated substances above ambient (background) levels, and may only be allowed based on necessary social and economic concerns.
DEQ	Montana Department of Environmental Quality
DFWP	Montana Department of Fish, Wildlife and Parks
DHES	Montana Department of Health and Environmental Sciences
diorite	A group of plutonic rocks intermediate in composition between acidic and basic, characteristically composed of hornblende, oligoclase or andesine, pyroxene, and sometime a little quartz; the approximate intrusive equivalent of andesite.
DNRC	Montana Department of Natural Resources and Conservation
DSL	Montana Department of State Lands
EA	Environmental Assessment
ECMA	Elkhorn Cooperative Management Area
EIS	Environmental Impact Statement - a comprehensive environmental document delineating a proposed action's effects on natural and human environment. An EIS gives an in-depth look at specific issues and cumulative effects in an area. Required by the Montana Environmental Policy Act (MEPA)
endoskarn	Skarn formed by replacement of intrusive or other aluminous silicate rock.
ephemeral stream	A stream that flows only as a direct response to rainfall or snowmelt events; having no baseflow.
et al.	and others
et seq.	and the following
evapo-transpiration	The physical separation of a liquid from a dissolved or suspended solid. Energy is released to the system to volatize the liquid, leaving the solids behind.

frigid temperature	Mean annual soil temperature below 47 degrees F (8 degrees C) at a depth of approximately 20 inches (50 cm).
geotextile	Synthetic material that is used in construction to create desired soil properties and conditions. Geotextiles are used to increase tensile and bearing strength for equipment access, to control water management and flow direction, and are used as filters between materials of varying particle size distribution.
gpd	gallons per day
gpm	gallons per minute
HRB	Hard Rock Bureau of the Department of State Lands prior to July 1, 1995, and of the Department of Environmental Quality after July 1, 1995.
hydric soil	A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic (water-loving) vegetation. Hydric soils that occur in areas having positive indicators of hydrophytic vegetation and wetland hydrology are wetland soils.
KvA	Kilovolt amps
LAD	Land application disposal of water. A method of disposing wastewater that relies on sprinkler application over a large area and/or percolation ponds. Disposed water may evaporate, be used by vegetation, or infiltrate to the groundwater system.
MCA	Montana Code Annotated
MEPA	Montana Environmental Policy Act
mesic	Intermediate or moderate moisture or temperature, or reference to organisms adapted to moderate climates.
mgL	milligrams per liter
μmhos/cm	micromhoms per centimeter, a unit of electrical conductivity
MMRA	Montana Metal Mine Reclamation Act

MPDES	Montana Pollutant Discharge Elimination System
MT	Montana
MWUA	Montana Water Use Act
Pegasus	Pegasus Gold Corporation
permeability	A relative property of material that allows for movement of water. Low permeability of impervious material such as clay would allow less water movement than the high permeability of a pervious medium such as sand and gravel.
pH	Measure of the acidity or alkalinity; 7 is neutral, low numbers are acidic
phreatic surface	water table
P.L.	Public Law
PM-10	Particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers.
porphyry	An igneous rock of any composition that contains conspicuous phenocrysts (larger crystals) in a fine-grained groundmass
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
Rock Quality Designation	Unit of measuring rock strength. Higher values indicate better rock quality.
ROD	Record of Decision
SC	Specific Conductivity, a measure of dissolved solids content
Section 106	Portion of the National Historic Preservation Act which requires investigation of cultural and archeological resources and consultation with the SHPO whenever federal property, funds, or agencies are involved in a proposed project.

SHPO	State Historic Preservation Office
skarn	The term is generally reserved for rocks composed mostly of lime-bearing silicates, derived from nearly pure limestones and dolomites into which large amounts of Si, Al, Fe, and Mg have been introduced.
subsidence	A surface expression of underground rock movement or caving.
sump	Catchment pond for collection of wastewater or runoff.
tailings	Fine-grained residual material left after metals (gold, silver) have been extracted from ore during milling.
transmissivity	The rate at which a substance (gas or liquid) passes through solid.
udic moisture regime	The portion of the soil above the water table which is not dry in any part for as long as 90 days (cumulative); occurs in a humid climate where the amount of stored moisture plus rainfall is approximately equal to or exceeds the amount of evapotranspiration.
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USFS	USDA Forest Service
VQO	Visual Quality Objective
wetlands	"Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances, do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." (40 CFR 230.3 and 33 CFR 238.3).

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